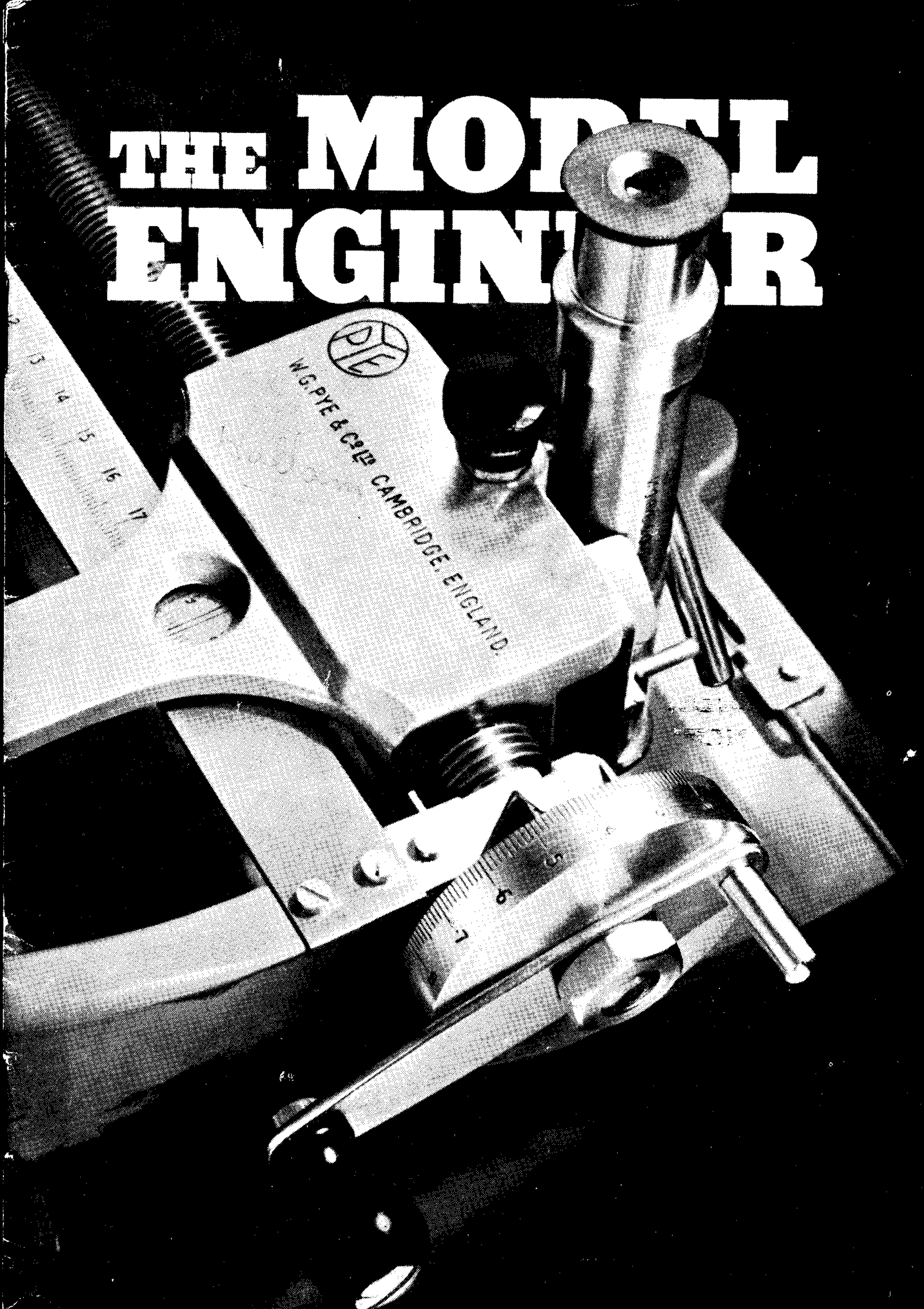
THE MODEL ENGINEER



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The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

23RD JUNE 1949

VOL. 100 NO. 2509

SMOKE RINGS

Our Cover Picture

● ONE OF the most important developments in modern engineering is the improvement of methods and instruments for precision measurements; new and more accurate devices are constantly being evolved to facilitate the work of the production engineer and enable him to work to finer limits.

Mr. Edward Leigh, of Cambridge, has submitted this striking photograph of a Pye precision microscope of the type used for checking the accuracy of jigs, gauges and other tools. The operating screw visible in the photograph must be made to the highest degree of precision, and the most scrupulous care is taken in its production. The steel from which it is machined is first heat treated, then aged for three months, after which a roughing cut is taken over it, and it is then left to settle down for another three months. It is eventually threaded on a Bryant & Saunders precision screw-cutting machine, the operator of which employs a low-power microscope to keep the accuracy constantly under observation while work is in progress.

Another Generous Prize

● THE CORONET TOOL CO., of Derby, are offering as a Competition prize at the "M.E." Exhibition a Coronet Home Cabinetmaker 3-ft. combination lathe complete with circular saw, value £13 10s. It is to be awarded to the best exhibit in what we consider to be the most suitable section for such a prize. Should the winner so desire, he may have, instead, a voucher to the value of £10 towards the purchase of any other equipment from The Coronet Tool Company's lists.

The final decision as to what particular exhibit shall qualify for this generous prize would best be left, we feel, until the judging is completed, or, at least until all the entry forms have come in. For much depends, of course, upon the equipment already possessed by the competitor; but we do not anticipate that the judges will have much difficulty in coming to a decision in the matter, once they are in possession of the knowledge as to the circumstances in which the exhibit was made.

"M.E." Exhibition Entry Forms

● READERS WHO intend to enter models for this year's show are reminded that time is beginning to run short. Forms should be filled up and returned to Mr. E. D. Stogdon, Exhibition Manager, Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2, as soon as possible. The closing date for the receipt of completed forms is July 11th.

The Southampton Exhibition

● AS PART of the Southampton Model Homes, Industrial and Fashion Exhibition, the Southampton and District Model Engineering Society organised an exhibition of their members' work and that of others in the Southern Federation. It was a very good and well-arranged show in a large, separate marquee. The exhibits comprised models of every description, conveniently grouped, and impressive by their number and variety. There was space, too, for a considerable length of multi-gauge passenger-carrying track on which locomotives were kept busy dealing with a heavy traffic.

The competition was very keen and presented a formidable task for Mr. Bedford, of Portsmouth, Mr. Maskelyne and Mr. Westbury, who undertook the judging. But it all passed off very well, and there can be little doubt that, so far as model engineering is concerned in that area, a resounding success was achieved.

News from Crosby

● WE DULY received a copy of the May issue of the Crosby Model Club Bulletin, and found some interesting items in it. For one thing, we learn that the committee has recently purchased a 2½-in. gauge railway ; the terms were so good, and it was so obviously a bargain, that there was not the least hesitation in making it the club's property. There were, we understand, many individual items which, in themselves, were worth twice the total purchase price.

The club seems to have been unusually fortunate in this deal, especially at the present time.

A recent approach to the local Parks Committee, for permission to make use of the pond in Coronation Park for the sailing of model boats, has been acknowledged by the Town Clerk, who states that he will place the request before the Committee. We hope to hear, in due course, that the permission has been granted.

Consulting Engineers for South Bank

● THE APPOINTMENT is announced of Messrs. Freeman, Fox & Partners as Consulting Engineers for the construction of the exhibition to be held on the South Bank of the Thames in connection with the Festival of Britain, 1951.

The firm of Messrs. Freeman, Fox & Partners was formed by Sir Charles Fox in 1857. At the time of the Great Exhibition of 1851, he was senior partner of the firm of Fox, Henderson & Company, who constructed the Exhibition Building in Hyde Park, afterwards re-erected at Sydenham and known as the Crystal Palace.

Exhibition at Belfast

● MR. R. WILKINSON, Press Relations Officer of the Model Engineers' Society (N.I.), has sent us a copy of the catalogue of the exhibition held by the society in Belfast, during May. Wellington Hall, Belfast, was the venue, and the exhibition was the third and largest to be organised by the society. In spite of the exceptionally good weather which decided to coincide with the exhibition, the latter was a great success, the hall having to be closed at times due to the large number of people inside.

There were upwards for 400 separate exhibits ; Mr. J. Dempster's 3½-in. gauge "Maisie" did great work on the passenger-carrying track ; Mr. S. Coulter's "M.E." road roller was also seen in motion, and there were frequent demonstrations of turning, drilling, shaping, etc., at the trade stands.

The Belfast Ship Model Society, Short Bros. and Harland's Model Engineering Society, the Ulster Model Yacht Club, the Belfast Model and Flying Club and the Radio Society of Northern Ireland all helped to swell the number of exhibits and to make the show a success. Enthusiasm for our hobby is evidently at a high pitch in Northern Ireland.

The Lure of the Locomotive

● A STATEMENT has recently been issued by British Railways, Midland Region to the effect that no fewer than 43,432 enthusiasts visited the 125 engine sheds on the region last year. Among them were schoolboys, grandfathers, engineering students and railway fans of all ages.

The largest number were Londoners, 16,500 of whom went to Willesden, Camden, Cricklewood and other local sheds. This total is a record one, and it shows that the railway engine maintains its hold on the public imagination. There can be no possible doubt that to go behind the scenes to see the servicing of giant locomotives before they start, or after they return from, their turns of duty is still a major thrill to the mechanically-minded.

But there is another aspect of the matter, which is clearly revealed in the figures ; it is the readiness with which the railway authorities and their staffs are willing to accede to the desires of locomotive enthusiasts. The granting of facilities enabling parties to visit locomotive sheds, and the subsequent arranging for guides and experts to be available at times when they would normally be attending to other and more urgent duties, or possibly enjoying some respite from their ordinary occupation, entails an amount of organisation that is by no means always apparent. For this, the enthusiasts are, or should be, eternally grateful ; no better means can be offered to the model engineer, for example, for obtaining information enabling him to make the details of his models correct to prototype practice. We know that not all the notebooks and pencils which are to be seen in use among parties of visitors to locomotive sheds are merely recording the names and numbers of the engines present ; some are being filled with sketches and dimensions of some vital part needed for a model under construction at home. Some locomotive components are more readily accessible when the engine is on shed than when she is standing in a station.

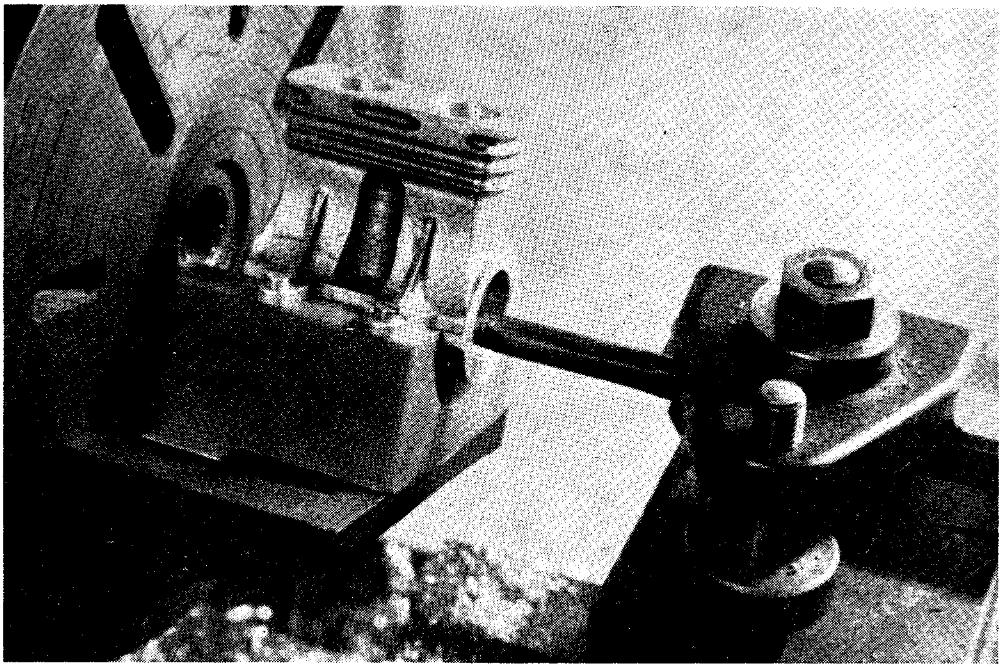
So, as our knowledge of locomotive anatomy is increased as a result of the permission given for us to examine locomotives at the closest possible quarters, let us not forget the debt of gratitude we owe to the railwaymen concerned, for their potent, if somewhat indirect, contribution to our pleasure.

PETROL ENGINE TOPICS

*A Twin-Cylinder 2.5 c.c. Compression-Ignition Engine

by Edgar T. Westbury

IN the machining of the die-castings for the "Ladybird" engine, operations have been considerably simplified by the fact that all ports and passages, except those for the inlet of mixture from the carburettor, are cast in and require no machining or other finishing processes. The original engine, made from sand castings, had only plain cored holes in the body casting, and it was necessary to employ milling and eccentric turning methods very extensively; but with the improved castings, the only operation of this nature is the formation of the internal eccentric groove which makes the communication between the central inlet passage in the casting and the inlet ports in the two cylinder liners.



Body and sump assembly mounted on angle-plate for boring main bearing housings

Body

The first operation on the body casting is the facing of the underside surface, and this can be done by holding the casting in the four-jaw chuck with this face outwards, and setting it to run truly over the tips of the holding-down feet. A keen and well-raked facing tool is then used to machine the surface, leaving the feet and the crankcase rim 3/32 in. thick. Care should be taken to ensure that this surface is as truly flat as possible, so that a gastight joint can be made; it can be lapped for final finishing, but it is not advisable to leave much metal to be removed in this way.

In the next operation, the surface first machined is used as the clamping face in mounting the casting on the faceplate for boring the cylinder seating and facing the top surface. The usual method of marking out the bore centres, by fitting wood or soft metal bungs and scribing cross lines on them, may be employed if desired, but the cored holes in the casting are so accurately placed that this is superfluous; it is quite sufficient to set up from the holes, to as high a degree of concentric accuracy as possible. Bore each of the holes to within one or two thousandths of an inch of finished size, and finish with a reamer or D-bit. The top surface of the casting is faced while set up for boring one of the seatings; when finished, this should be exactly $1\frac{3}{8}$ in. from the base surface.

It is possible now to form the eccentric grooves for the inlet passages, though the operation may

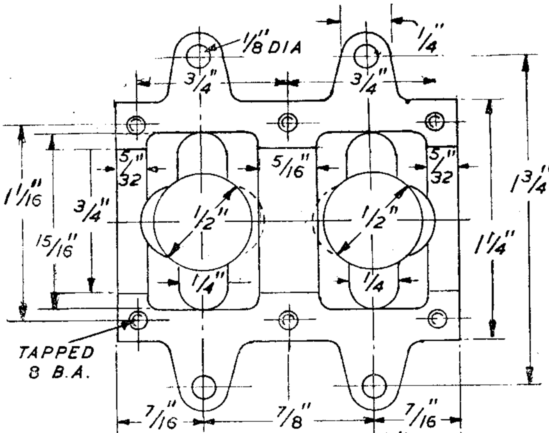
*Continued from page 698, "M.E.," June 9, 1949.

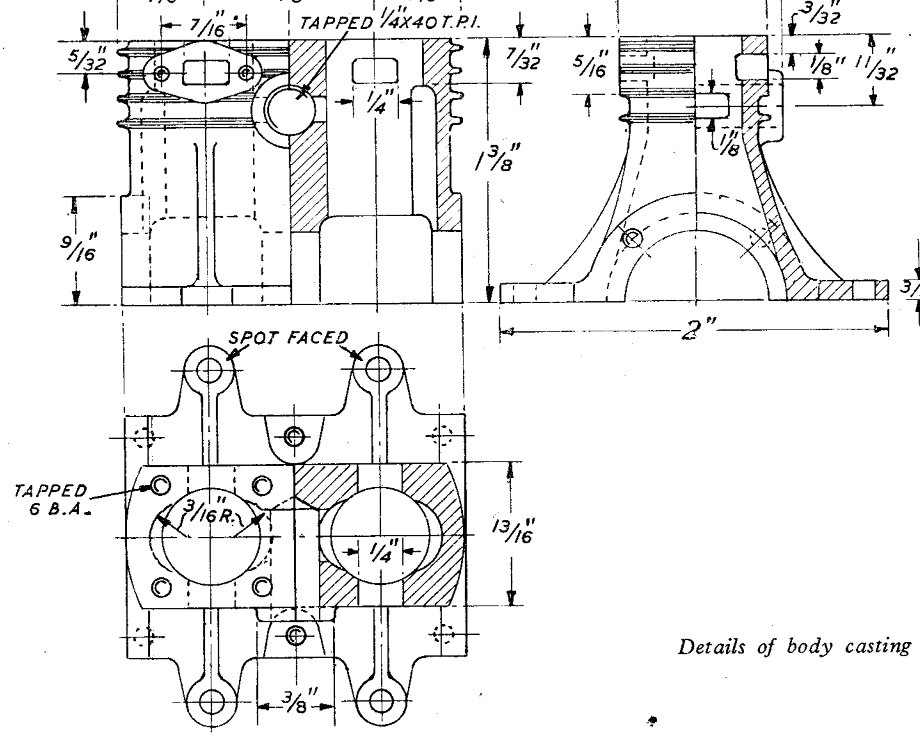
be deferred to a later stage if desired. A special internal tool should be made, preferably by turning down a piece of $\frac{3}{8}$-in. diameter silver-steel to a shank diameter of about $\frac{3}{16}$ in. for a length of $\frac{1}{2}$ in. or so, leaving a collar $\frac{1}{8}$ in. wide at the end, well undercut on both sides. This collar may now be filed to shape, either as an orthodox form of boring tool or simply notched to produce a circular form tool, after which it is hardened and tempered, leaving the shank as soft as possible. A split holder or a vee packing block may be used to mount the tool in the tool post; its shank should be exactly at centre height, and parallel with the axial centre of the lathe mandrel.

For the eccentric setting of the bores in the body, it is advisable to use a shouldered metal bung, turned to a tight push fit in the bore and marked out on the front face with a sharp and distinct centre-line, having a centre-punch dot $\frac{1}{8}$ in. from the concentric centre. This is inserted in the bore, with the centre-line disposed exactly longitudinally to the casting, and the dot inwards. The casting is now shifted on the faceplate until the dot runs truly, after which the bung is removed. This procedure, of course, holds good for each of the two bores in the casting.

It will be seen that the centre of the inlet passage is 11/32 in. below the top face of the casting, which means to say that the internal grooving tool must be fed into the bore until its cutting edge is centred at this distance; that is to say, the "leading" edge is 13/32 in. from the outer face, and the "trailing" edge 9/32 in. from it. The easiest way to measure this is first to advance the tool till it lightly touches the top face of the casting (the lathe being stationary, of course), then feed it inwards by means of the cross-slide to clear the bore, and advance the top-slide or saddle another 13/32 in., using the slide index or any other convenient method of measurement to verify this.

Before starting the lathe, make quite sure that



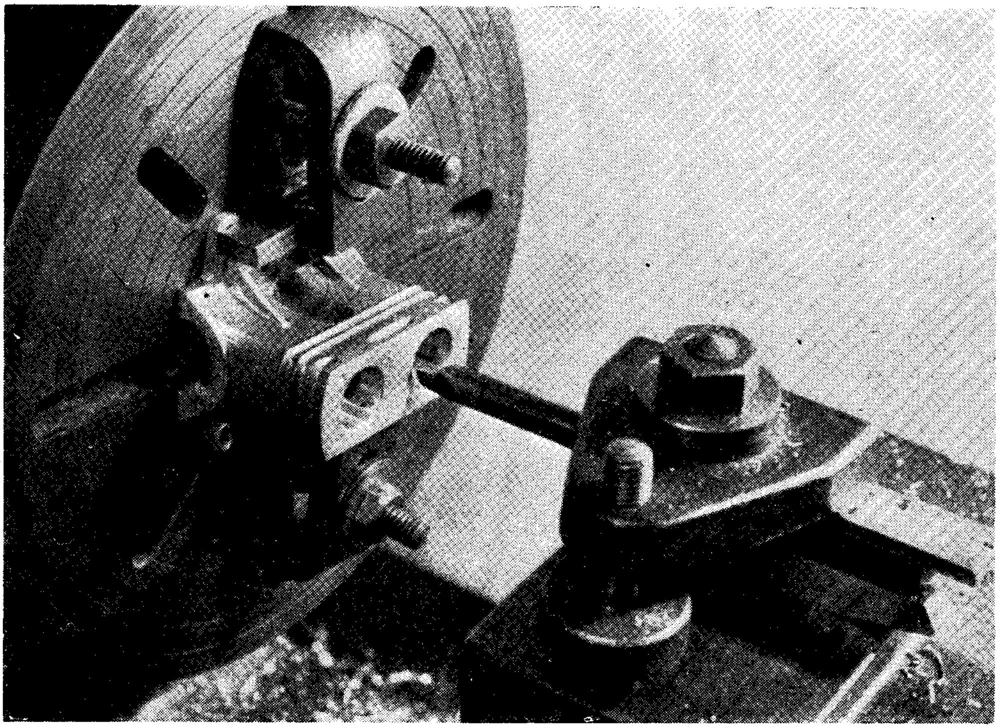


Details of body casting

the tool is not fouling the wrong side of the bore or anywhere else. In forming the groove, only the cross-slide feed must be used, and the lathe should be run slowly and cautiously. Note the point at which the tool first begins to cut, and make use of the cross-slide index (if available) to measure the depth of cut, which should be a full $\frac{1}{16}$ in., but on no account should the shank of the tool be allowed to rub on any part of the bore, as this may affect the gas seal between the ports, if the bore surface becomes scored. Note that the location of the groove does not directly affect port timing, but it must open up full communication with the ports in the liner, and should not be unnecessarily wide to produce dead spaces or " pockets " in the passage.

Those who may contemplate building an engine on these lines from solid metal, or simple sand castings, may note that similar methods of eccentric boring may be used to form the transfer passages, though the methods of procedure vary slightly. The same bung is used for setting up, but it is turned half-way round so that the dot faces outwards relative to the casting. A round-ended boring tool is used, and must have a longer shank to enable it to be traversed endwise as far as the crankcase tunnel, the depth of cross-feed being the same as before. In this case, still greater care is necessary to avoid excessive depth of feed or scoring of the main bore, as there is risk of leakage from the transfer passage to the exhaust ports if this should occur.

Further operations on the body casting are carried out with the sump casting attached, so attention to this casting is necessary.



Boring the cylinder liner seatings in the body casting

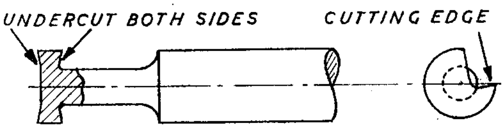
Sump Casting

I may possibly be reminded that this part is not a sump in the true and literal sense of the term, so I will anticipate this criticism by saying that I am well aware of the fact, but my excuse is that the term is universally applied to the lower part of an engine crankcase, when this constitutes a separate component, whether it is utilised as a drainage well or otherwise. The main machining operation on this item consists of facing the top surface, holding it across the jaws of the four-jaw chuck with the surface set to run as truly as possible in the cross-plane. It should be machined with the same care as the corresponding face of the body, after which the holes for the screws securing the parts together should be drilled, the sump being dealt with first, and the tapping holes in the body jigged or " spotted " from it. The outer faces of the holes in the sump should be spot-faced to provide an accurate bearing surface for the screw heads. Before fastening the parts together for further machining (using temporary screws for preference) the joint surfaces should be carefully lapped on a piece of plate glass and tested on a surface plate

to make sure that they are exactly flat. The holes in the feet should be marked out, drilled and spot-faced, as they can well be utilised in mounting the casting for further machining.

Mounting Block

The operations which involve centring the casting about the horizontal centre-line of the crankcase are carried out by mounting the casting assembly on an angle plate. It will be necessary to use parallel packing pieces under the feet, to raise the sump clear of the angle plate, and these may well be made with a view to their future use as engine bearers. In building the prototype engine, I decided to use a block of paxolin board which happened to be available for this purpose, and it was therefore machined to appropriate form before proceeding further. It was mounted eccentrically in the four-jaw chuck and drilled through lengthwise, then opened out by boring so that the hole broke out at the side, a piece of wood being interposed on this side so that the tool did not foul the chuck jaw, and boring continued to produce a groove 1¼ in. wide between the "horns." The top face of these, also the underside of the block, were machined parallel, and the engine mounted thereon by temporary set-screws, two O-B.A. screws being tapped in the underside of the block to secure it to the angle plate. Practically all subsequent work on the engine, including machining, assembly, and testing, were carried out with it attached to the block, which greatly facilitated handling.

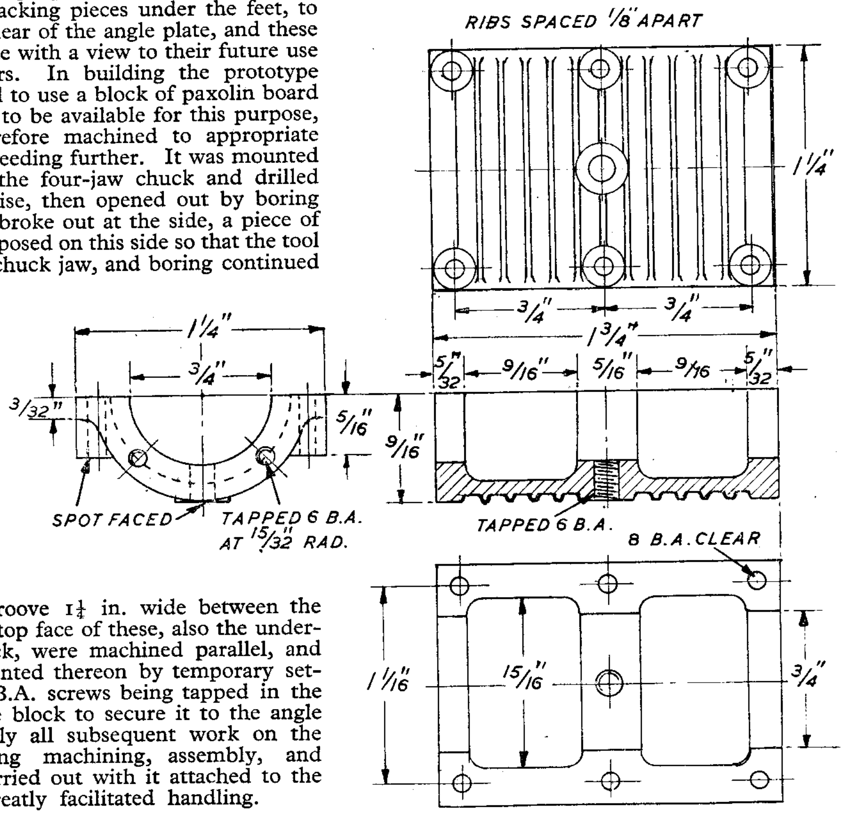


Suggested form of internal recessing tool for machining inlet ports

Boring Crankcase Tunnel

Having set up the assembly on the angle plate, and verified that the joint face of the crankcase is square with the faceplate when mounted thereon, also that the sides of the casting are exactly square with the faceplate in the other plane, the angle plate may be adjusted in position to bring the centre of the crankcase concentrically true. Check up on the outside of the end flange, which is circular over the main portion of its contour. The end surface may now be faced and the crankcase tunnel bored right through ⅝ in. diameter, working to as close an accuracy as possible in dimensions and parallelism. It should not be necessary to touch the chambered portions of the crankcase spaces if the work is properly set up, but they may be skimmed out if it is found desirable. A mandrel may be used to mount the assembly for facing the remote end of the crankcase.

In the construction of the prototype engine, an orthodox form of split bronze shell was used for the centre bearing, and this involved some rather difficult operations which it has been considered desirable to avoid in the final design. The small bore of the centre housing in the casting made it necessary to machine the register bores for the end bearings in two operations, always a precarious job in so small an engine; and the split "brass" had to be made by "dead reckoning," both in respect of outer diameter and length between flanges, as it was impossible to "offer it up" to the housing in the course of machining. By making the register bores of the three bearings all the same size, and using a split bronze diaphragm for the centre bearing, the fitting of the



Details of sump casting

(*Continued on page* 775)

Two Vertical Marine Engines

by G. A. Nurthen

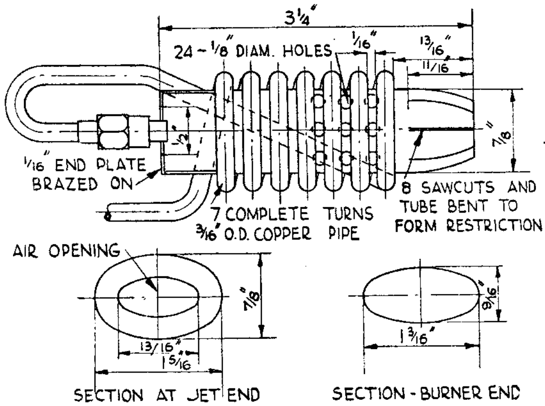
BEFORE going on to describe the two engines illustrated, perhaps it would be in order for me to start with a brief description of the boiler and blowlamp, since, although originally constructed for use with engine " No. 13," they were, during the test, used for both engines.

The boiler is twin-drum and of copper throughout. The drums are $5\frac{3}{4}$ in. long by $2\frac{1}{4}$ in. diameter, and are coupled together by six 5/16-in. diameter tubes. Each drum is fitted with a relief-valve set to blow at 75 lb. per sq. in.

Fittings include a 0-150 lb. pressure-gauge, a 7/32-in. diameter glass water-gauge with blow-down cock and a pair of delivery check valves.

The steam from the dome passes through superheating coils wound between the water-tubes.

The boiler is silver-soldered and flanged end-plates are used. It was subjected to a hydraulic test of 180 lb. per sq. in., and to a steam pressure of 100 lb. per sq. in. The weight full is 5 lb.



Details of the paraffin blowlamp

The blowlamp has proved highly successful, though the contrary was expected when it was being constructed, and it was designed to be easily modified if necessary.

The oval shape of the flame-tube and nozzling down gives a slightly splayed fan-shaped flame which spreads over the boiler heating area.

A hand-pump and stop-valve are fitted to the container.

Engine No. 12

With a bore/stroke of $\frac{3}{4}$ in. × $\frac{3}{4}$ in., this engine is of the single-acting, cam-operated poppet-valve type, fitted with screw-down control-valve, quick operating throttle, water-pump geared 16 : 1, oil-pump geared 56 : 1 and drip-feed lubricator. It is shown mounted on temporary bearers for bench running.

The cylinder is of gunmetal, the piston phosphor-bronze, and valve of hard cast phosphor-bronze. The connecting-rod is duralumin with phosphor-bronze bushes.

The crankshaft, of $\frac{1}{4}$-in. diameter silver-steel

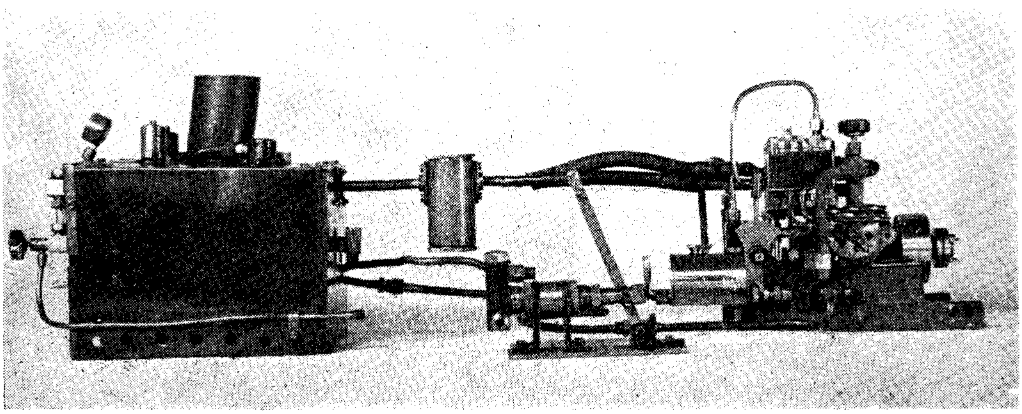


Photo by] [*R. H. Purvis*

Engine No. 12 connected to the twin-drum boiler

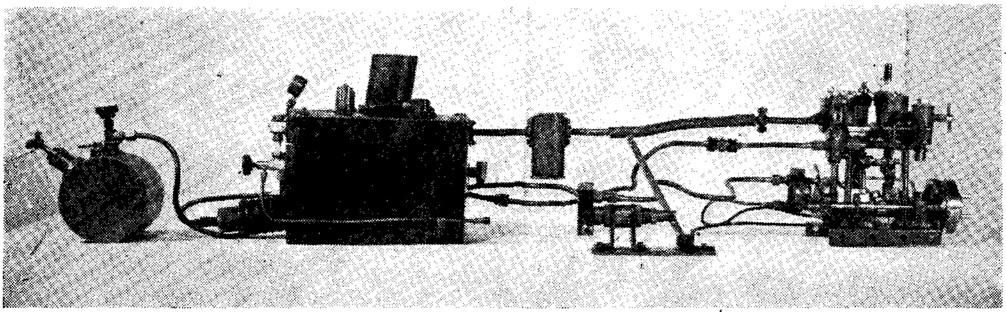


Photo by] [*R. H. Purvis*

Engine No. 13, *twin-drum boiler and blowlamp*

runs in a totally enclosed ball-race at the forward end and a phosphor-bronze bearing aft.

The valve is fitted with a hardened steel roller, spring-loaded to keep contact with the cam profile. The cam, which has a lift of 7/32 in., is of case-hardened mild-steel, and is secured to the crankshaft by two 4-B.A. grub-screws locating in registers in the shaft. The spindle of the valve roller projects $\frac{1}{4}$ in. from the valve and runs in a crosshead, thus preventing rotation of the valve and helping to counteract side thrust. Two exhausts are fitted, one being valve and the other uniflow.

The engine is entirely built-up and weighs 3 lb. 4 oz. At a steam pressure of 75 lb., 5,000 r.p.m. have been recorded.

Engine No. 13

This engine, with a $\frac{7}{8}$-in. bore × $\frac{3}{4}$-in. stroke, is of the double-acting piston-valve reversing

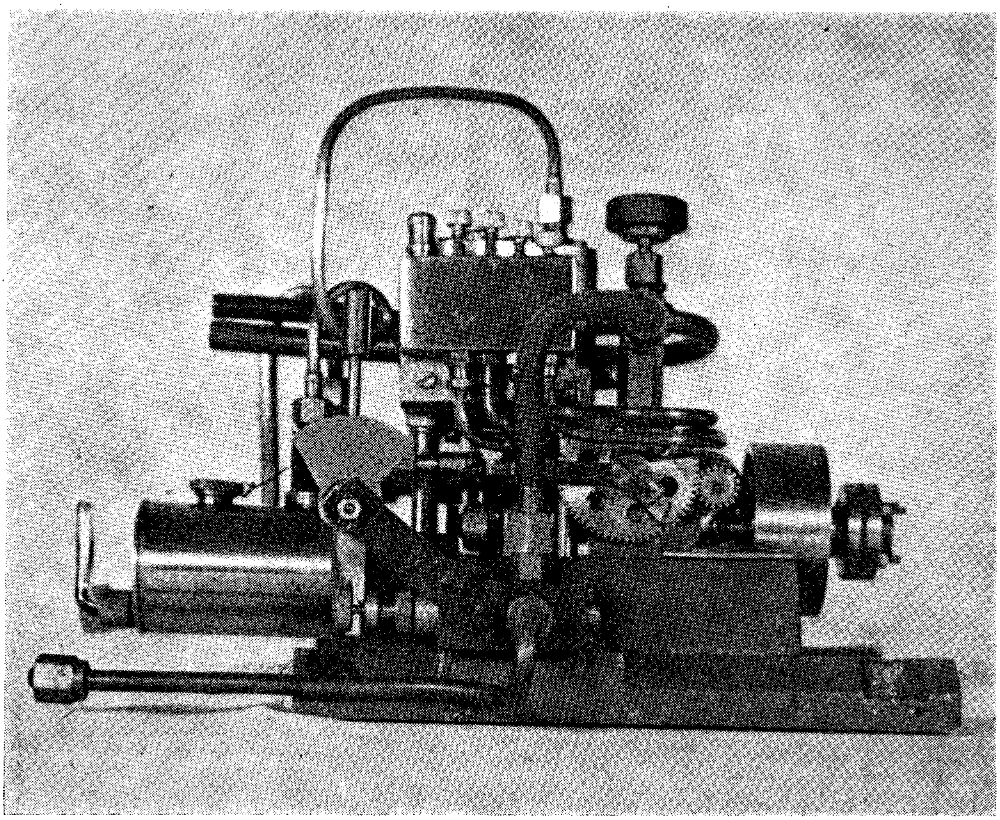


Photo by] *Engine No.* 12—*Port side* [*R. H. Purvis*

type and is mainly built-up, with the exception of the base, which is a foundry casting in aluminium alloy from my own pattern.

The cylinder block is of close-grained cast-iron, with the piston of the same material. The latter has a groove turned circumferentially and packed with graphite yarn.

The engine is mounted on a temporary inverted channel section base for bench testing, and the engine-driven pump is connected by a tee-connection to the same delivery pipe as the hand-pump. The plunger-type of regulator, as seen on the steam inlet pipe to the engine, was originally intended to be operated by a solenoid

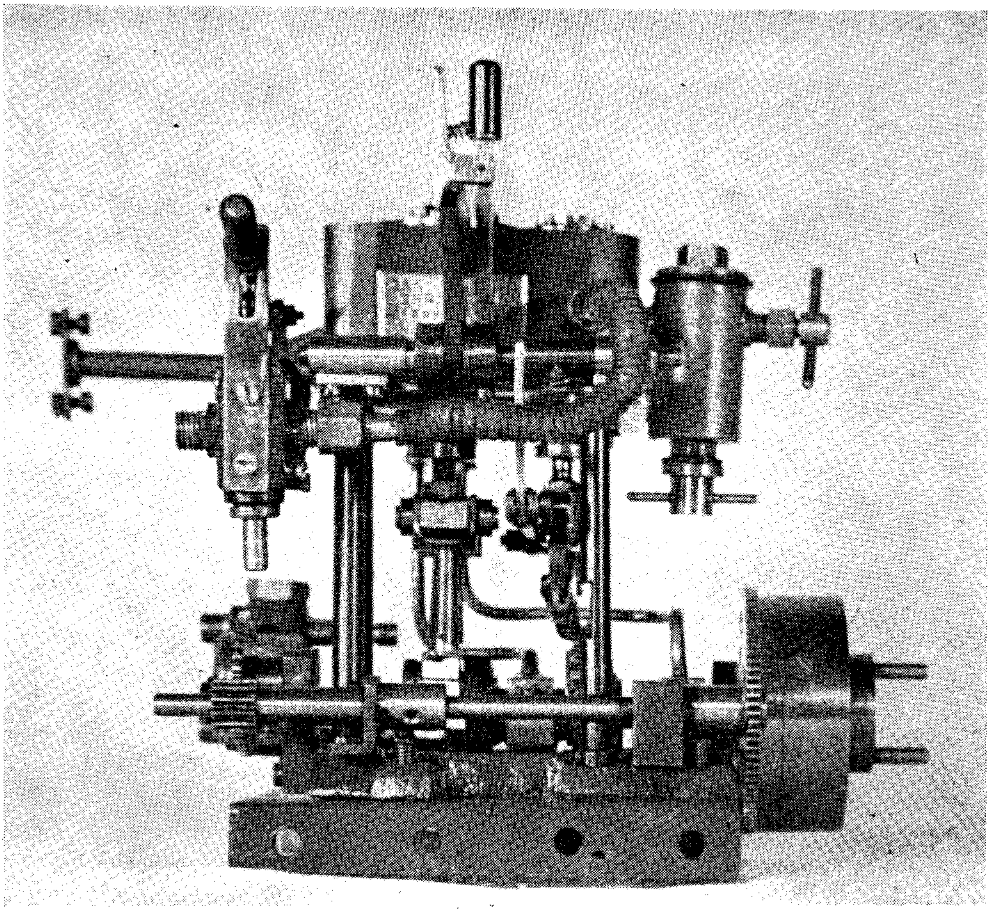


Photo by] [*R. H. Purvis*

Engine No. 13—*port side*

energised by radio control, but I haven't quite got around to that yet.

The valve is 7/16 in. diameter and of hard cast phosphor-bronze. Like the piston, it is a lapped fit into the cylinder block.

Fittings

These include a displacement lubricator, drip-feed lubricator, $\frac{1}{4}$ in. diameter $\times$ $\frac{5}{16}$ in. stroke boiler feed-pump driven at a reduction of 12 : 1 through two sets of reduction gears. The main bearings are of hard cast phosphor-bronze carried in plummer blocks.

Stephenson's reverse gear is fitted and, as can be seen, is operated by a lever and fixed sector.

Speed

Running speed is about 3,000 r.p.m. at 50 lb. pressure, and it is extremely powerful, yet economical on steam. The height is $5\frac{1}{2}$ in., width $4\frac{1}{2}$ in., length overall $5\frac{1}{2}$ in. and weight 4 lb. 2 oz.

The base is cellulosed dark blue; the columns, reversing sector, lever and links oil blued; the brass fittings, oil pipes and the drip-feed lubricator are buffed and lacquered, and the pump body cellulosed red.

Traction Engines not so Well Known

by Ronald H. Clark, A.M.I.Mech.E.

IT is a heartening sign that today there is undoubtedly an increasing interest being shown and taken in our old familiar but fast disappearing friend the Traction Engine. I am one of those curious individuals who can never pass one. I have stopped to inspect scores and have photographed nearly as many, and over the years collected an interesting store of traction engine literature.

This series of articles is devoted to those makes not usually met with, but which the enthusiast may still expect to find in his journeys and explorations about our cherished countryside. In some few instances, examples which no longer exist are given, because of the original and technical interest they possess.

Some of the information and illustrations to follow have already been published in *Engineering* and I wish to thank the editor of that journal, Mr. J. Foster Petree, M.I.Mech.E., for his courtesy and kindness in allowing me to re-use some of this data and in putting the blocks at my disposal.

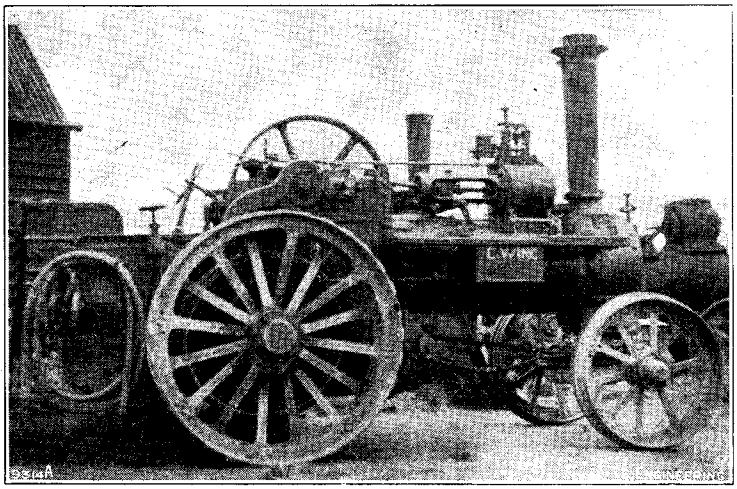


Fig. 1. 6 *n.h.p. Allchin light traction engine*

At the present rate of destruction it will only be a very few years before most traction engines are gone and examples by the larger makers will be the last to go, but before then the smaller number of those by the not so well-known makers will have gone to the scrap-heap. This fact alone makes the study of the smaller maker's products very interesting and also the matter of a little urgency.

Let us now consider these manufacturers in alphabetical order, the first being :—

I—William Allchin & Co. Ltd., Globe Works Northampton

Originally established in 1847 with premises in Augustone Street, Northampton when William Allchin commenced making agricultural machinery and in 1862 his first traction engine. This had a chain drive, single speed and worked at the then high pressure of 150 p.s.i. Twenty years later the single-cylinder, 9 in. × 12 in., had become steam jacketed and the nameplate bore the legend " William Allchin Engineer." In 1876 a new site near South Bridge in Northampton was acquired and a new works with much new plant was erected.

The first of his geared engines had two speeds and were of the three-shaft type having the slow-speed pinion on the flywheel side and the fast-speed on the opposite side. Some years later the general purpose engines were redesigned, incorporating the four-shaft layout and it was about this time too that the title of the firm became " William Allchin & Co. Ltd." and the nameplates rewritten accordingly. Again, to meet customer's wishes who desired replacement three-shaft engines in place of old ones they had ordered many years before, a new design of three-shaft traction was made complementary to the four-shaft so that any customer could buy the type of his choice.

Three- and four-shaft engines were powered by single or compound cylinders and with two or three speeds. A light type 6 n.h.p. four-shaft single-cylinder engine is shown in Fig. 1 and a fine three-speed double crank compound road locomotive in Fig. 2. Trunk crosshead guides were always used, the cylinders being steam jacketed as already mentioned and fitted with two 1¾ in. Ramsbottom safety valves on the top. The compounds worked at 180 p.s.i., and the singles at 140 p.s.i. The main dimensions are compared in Table 1.

When a single-cylinder road locomotive was asked for, the dimensions remained as in Table I except that the cylinder sizes became as follows :

N.H.P.	5	6	7	8
Bore	7¾ in.	8¼ in.	8¾ in.	9¼ in.
Stroke	9 in.	10 in.	12 in.	12 in.

A point to notice in Fig. 2 is that the high-

speed driving pinion is placed close to the crankshaft bearing with the low-gear pinion on the end of the shaft, an arrangement first produced by Charles Burrell & Sons who answered their critics by saying that as an engine was far more in high speed than in low, the pinion which therefore had the most work to do was close to the bearing, which is good engineering practice. That is was successful is proved by the number of engines turned out by Burrells themselves and the fact that the arrangement was copied by others.

After about 1906, Allchin's made some handsome looking rollers using the main items of their traction engine as a basis and made on the three-shaft principle. Some were of the "convertible" form which could be quickly converted into a traction engine or vice versa by using certain extra fittings, usually comprising new smokebox and front axle and, of course, extra front and rear wheels. Some were supplied in the Northamptonshire area and are still to be found at work.

Shortly after 1900, the firm entered the four-shaft versus three-shaft controversy by testing two identical 7-n.h.p. engines with the same load and under the same conditions. With equal boiler pressure on the same hill and with the same load, the three-shaft engine hauled the load with the reversing lever in the second notch, but the four-shaft engine had the lever right over. Previously, Charles Burrell & Sons Ltd., had also carried out a similar test but slightly different in detail. They experimented to see the maximum load hauled by each engine, allowing each engine to develop all it could, and the result was that a 25 per cent. greater load was hauled by the three-shaft example. Burrells made no more four-shaft engines after this and used the three-shaft layout exclusively in their road locomotives, tractions and rollers. The loss, of course, is due to the friction of the fourth shaft, and the writer has noted that when descending a hill on a three-shaft showman's engine, the flywheel brake had to be applied harder than with the same load on the same hill

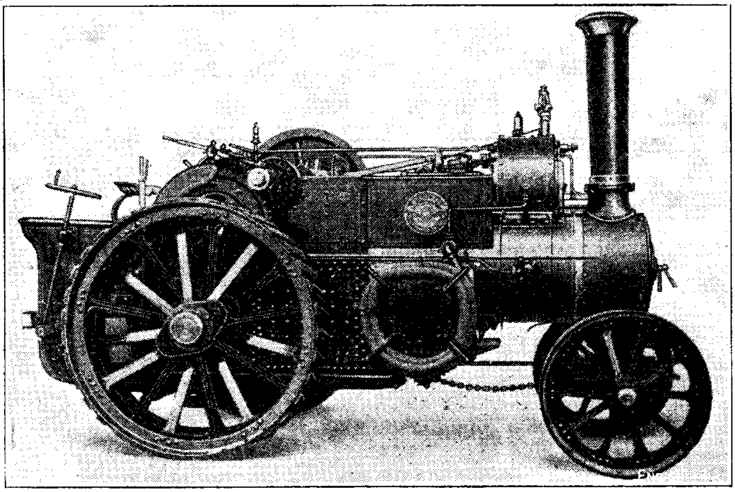
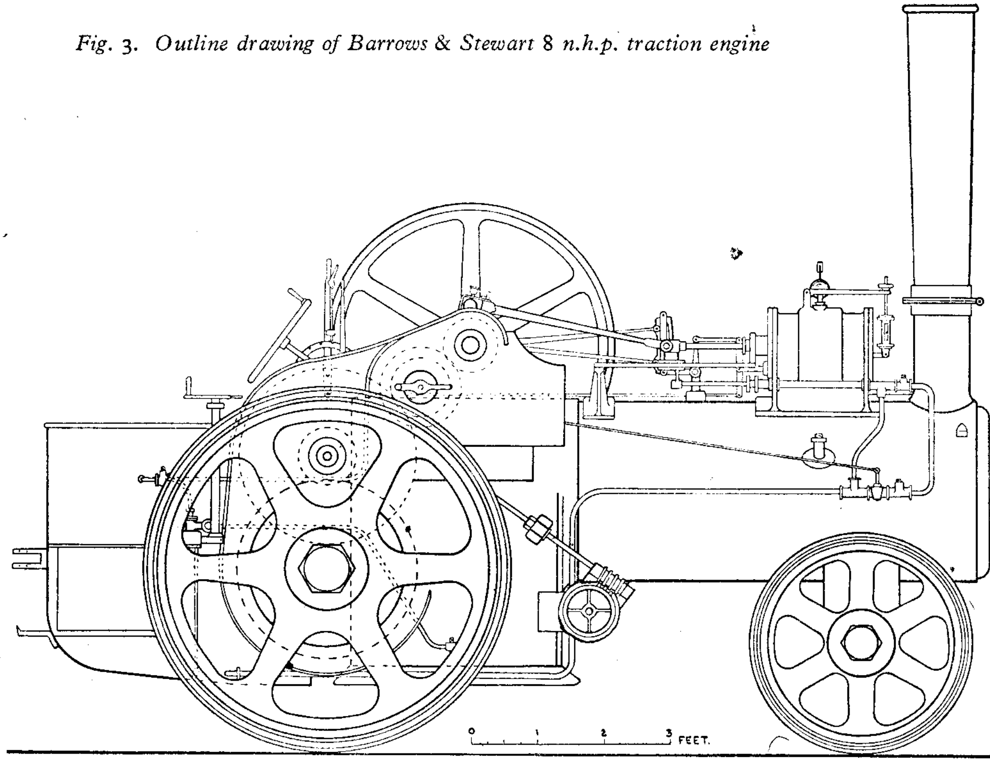


Fig. 2. Allchin double crank compound three-speed engine

TABLE I—Main Dimensions of ALLCHIN Traction Engines

	Agricultural Engines				Road Locomotives			
	Single-cylinder				Compound			
N.H.P.	5	6	7	8	5	6	7	8
B.H.P.	—	28	32	38	—	28	32	38
Cylinder Dia.	7½″	8″	8½″	9″	5″ & 9″	5¾″ & 9½″	6″ & 10″	6¼″ & 10½″
„ Stroke	9″	10″	12″	12″	9″	10″	12″	12″
Flywheel Dia.	—	4′-4½″	4′-6″	4′-6″	—	4′-4½″	4′-5½″	4′-6″
„ Width	—	5½″	5¾″	6″	—	5½″	5½″	6″
R.P.M.	—	145	140	140	—	145	140	140
Driving Wheels Dia.	—	5′-6″	5′-9″	6′-0″	—	5′-9″	6′-0″	6′-3″
Driving Wheels Width	—	16″	16″	16″	—	16″	16″	16″
Extreme Length	—	16′-2″	16′-6″	17′-9″	—	16′-2″	16′-6″	17′-9″
„ Width	—	6′-9″	7′-0″	7′-3½″	—	6′-9″	7′-0″	7′-3½″
Speed M.P.H.	—	2 & 4	2 & 4	2 & 4	—	2 & 4	2 & 4	2 & 4
Weight Empty	—	8½T	9¼T	10¼T	—	9¾T	10¼T	11½T
„ in W.P.	—	9¾T	10½T	11¾T	—	11T	11½T	13T
Load in low Gear	—	28T	38T	48T	—	30T	40T	50T

Fig. 3. Outline drawing of Barrows & Stewart 8 n.h.p. traction engine



behind a four-shaft engine. The difference in braking is due to the three-shaft locomotive running much freer than the four.

Allchins made their last traction engine in 1926, and this proved to be a most economical engine due mainly to the fact that the front cylinder cover had a recess to fit part of the way into the bore, after their steam wagon style, so that the steam clearance losses were reduced to a minimum, the piston being made hollow to pass

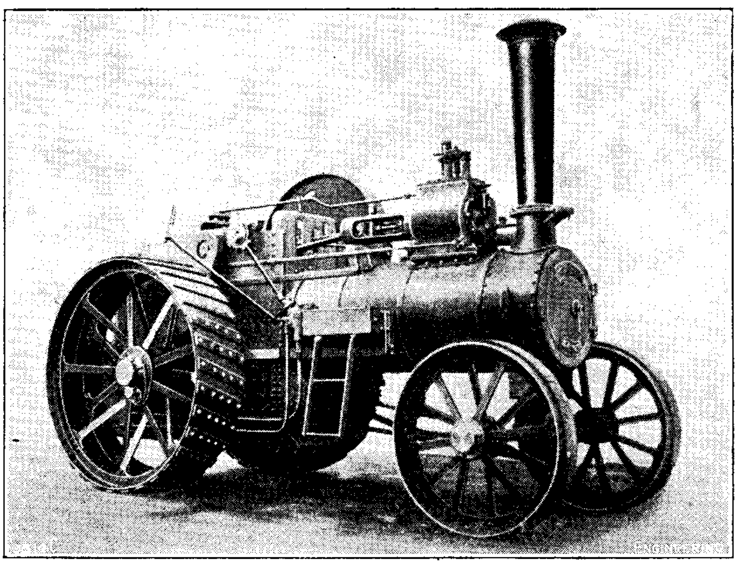


Fig. 4. Brown & May general-purpose traction engine

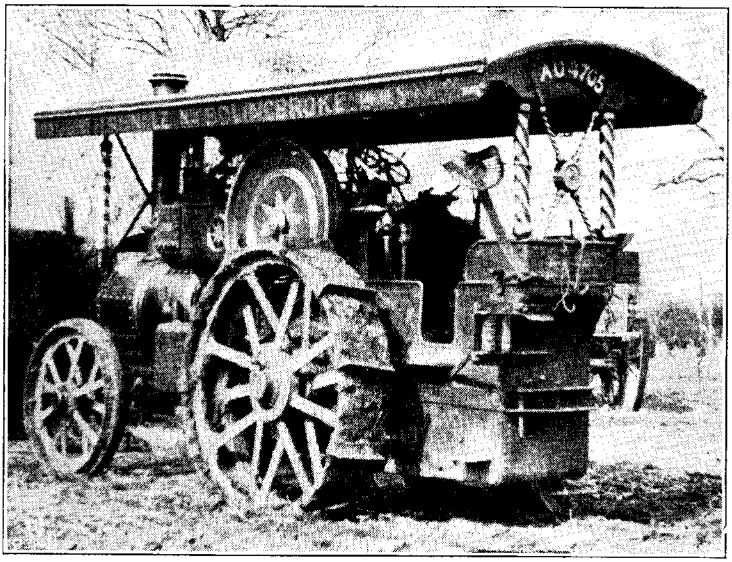


Fig. 5. Brown & May 5-n.h.p. showman's engine

over the projection. This engine went to Gleadless, near Sheffield, and was inspected by the author last autumn.

II—Barrows & Stewart, Banbury

Formerly Kirby & Barrows and then Barrows & Carmichael, this small firm originally turned out threshing-machines and portables; but at the Smithfield Show in 1879, they exhibited a single-cylinder traction possessed of several interesting features. It had the short boiler utilised on their portable engines and an outline drawing of it is included in Fig. 3. What appears to be the second motion shaft is actually a stud shaft fixed to the offside wrought-iron cannon bracket carrying an idler pinion, and this pinion gears into another pinion on the crankshaft and the spur wheel on the third shaft. This third shaft carries at each end a pinion, driven and controlled by a dog-clutch and meshing with its corresponding gear-ring adjacent to each rear road wheel. The maker's claimed that no differential was necessary, because either road wheel could be clutched out of gear when rounding a sharp bend into a gateway. This gearing, therefore, allowed for one speed only which, Messrs. Barrows & Stewart claimed, was enough for an ordinary threshing-engine. Note particularly that all wheels are of wrought iron, fabricated up from two circular discs with six

TABLE II—Main Dimensions of BROWN & MAY Traction Engines

	5-Ton Tractors		Traction Engines		
	Single-Cylinder	Compound	6 N.H.P.	7 N.H.P.	8 N.H.P.
Cylinder Dia.	6½″	4½″ & 7½″	8″	8½″	9″
,, Stroke	8″	8″	12″	12″	12″
R.P.M.	200	200	175	175	155
Flywheel Dia.	3′-0″	3′-0″	4′-0″	4′-0″	4′-6″
,, Face	5½″	5½″	6″	6″	6½″
Rear Wheels Dia.	4′-9″	4′-9″	6′-0″	6′-0″	6′-3″
,, ,, Width	1′-0″	1′-0″	1′-4″	1′-4″	1′-6″
Front Wheels Dia.	3′-2″	3′-2″	3′-9″	4′-0″	4′-0″
,, ,, Width	5″	5″	9″	9″	9″
Total length	12′-9″	13′-4″	17′-2″	17′-11″	18′-3″
,, width	5′-8½″	5′-8½″	6′-8″	6′-8¼″	7′-7″
Height to top of flywheel	6′-10½″	6′-10½″	8′-5½″	8′-7½″	9′-3″
Speeds M.P.H.	3 & 5	3 & 5	2½ & 4	2½ & 4	2½ & 4
W.P. p.s.i.	200	200	175	175	155

holes punched out in each to form six spokes, the plates being secured to the cast iron flanged hubs and connected to the treads by angle-iron rings, one to each plate. Rear wheels were 5 ft. 4 in. diameter × 14 in. tread, front 3 ft. 4 in. diameter × 8 in. tread.

In Fig. 5 we see their fine double-crank compound 5-n.h.p. steam tractor, in the form supplied to showmen, which has cylinders $4\frac{1}{2}$ in. × $7\frac{1}{2}$ in. × 8 in. and a solid forged crank-shaft. A smaller edition of this popular engine was also made called the "Dreadnought," and

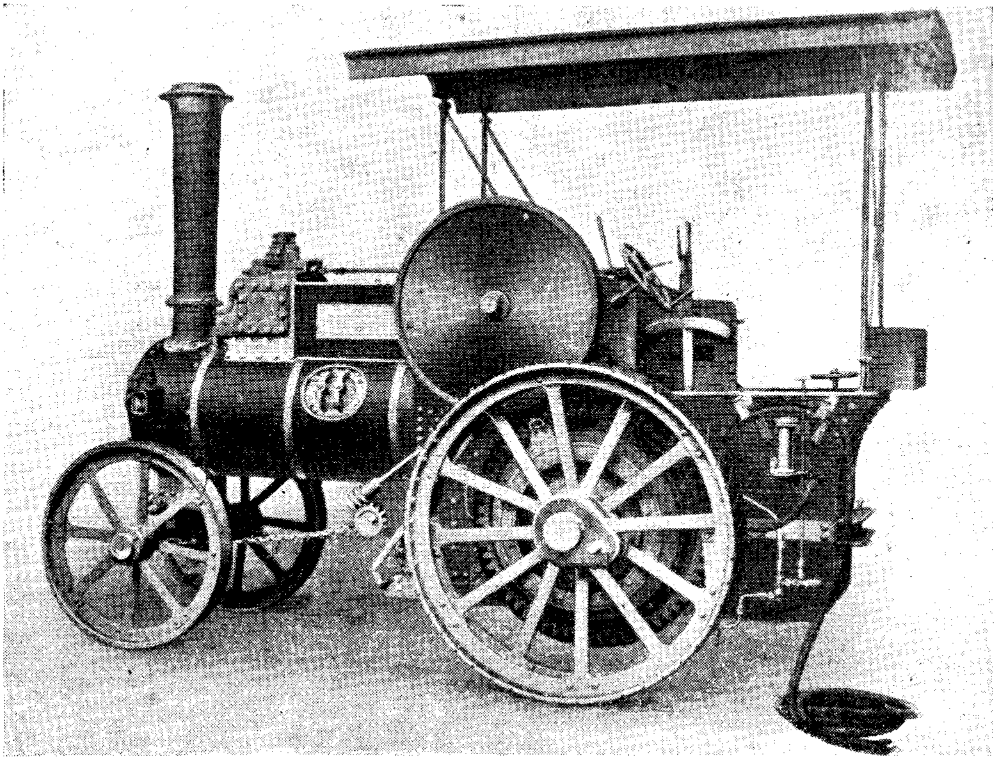


Fig. 6. Brown & May's little single-cylinder "Dreadnought"

a very sturdy little job it was for its size, being rated at only 4 n.h.p. It was a stock production having a cylinder $6\frac{1}{2}$ in. × 8 in. and was spring-mounted. A view of one is seen in Fig. 6. Both the tractors did not exceed 5 tons weight unladen, to comply with the Act of 1905. Table II gives in tabular form the main dimensions of the last engines to be made.

Brown & May engines are still to be found at work, mainly in Southern England, although the fine example shown in Fig. 5 is still in use in Lincolnshire (a happy hunting-ground for the traction enthusiast) and the author has happy memories of this silent-running machine making light work of driving a 54 in. threshing-drum and resplendent with all the brasswork polished, including the solid brass handwheels. Brown & May finally closed down in 1912.

Most showman's engines bore names, and that in Fig. 5 was called *General Buller*, works No. 8742, while other engines of this make, and used by showmen, were called *Oceana* and *Little Jim*.

(*To be continued*)

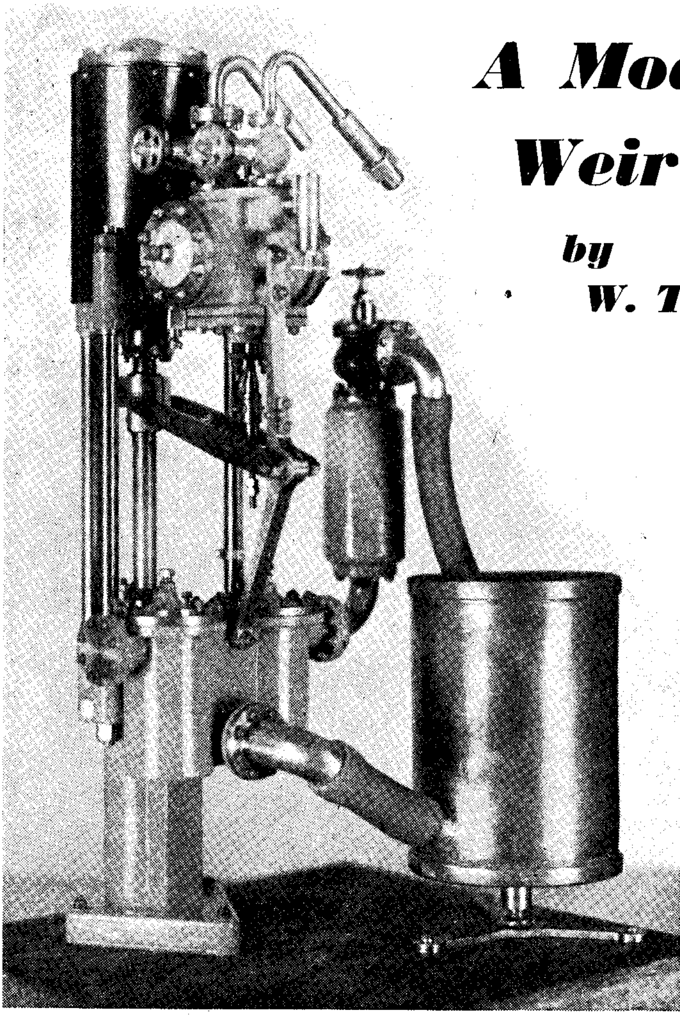
The single cylinder was $9\frac{1}{2}$ in. × 13 in. and the engine rated at 8 n.h.p. having a boiler 9 ft. 7 in. overall length × 2 ft. 8 in. diameter of shell. Other features were a brake to the rear axle and a starting lever, mounted on the centre of the backhead, which could be locked in the off position—a useful adjunct if the driver wanted to have a meal and yet leave the engine safe if there were venturesome boys about at the time. There were one to two of these engines in the Fen country until during the first war.

III—Brown & May Ltd., North Wilts Foundry Devizes

A country firm, established in 1854, who were very early in the field with portables which became renowned for their economy in fuel. Their first traction engine was a single-cylinder chain-driven job completed in 1864. Their later type is seen in Fig. 4. Trunk guides were used and other features include slide-valve on the outside of the cylinder, crankshaft from the solid bar, two speeds, differential on the rear axle which could be locked, disc flywheel and Ramsbottom safety-valves.

A Model Weir Pump

by W. T. Barker,



Front view of the model Weir pump

FOR a long time I had had it in mind that some day I would build myself a model of a Weir pump, a type very familiar to marine and station engineers for 50 years past and still in common, though, perhaps, not quite so common, use today. And so, at last, I wrote to Messrs. Weir who were good enough to send me a print of their standard 12 in. × 9 in. × 24 in. boiler feed-pump from which the model illustrated and briefly described here was made to a scale of 1 in. to 1 ft.

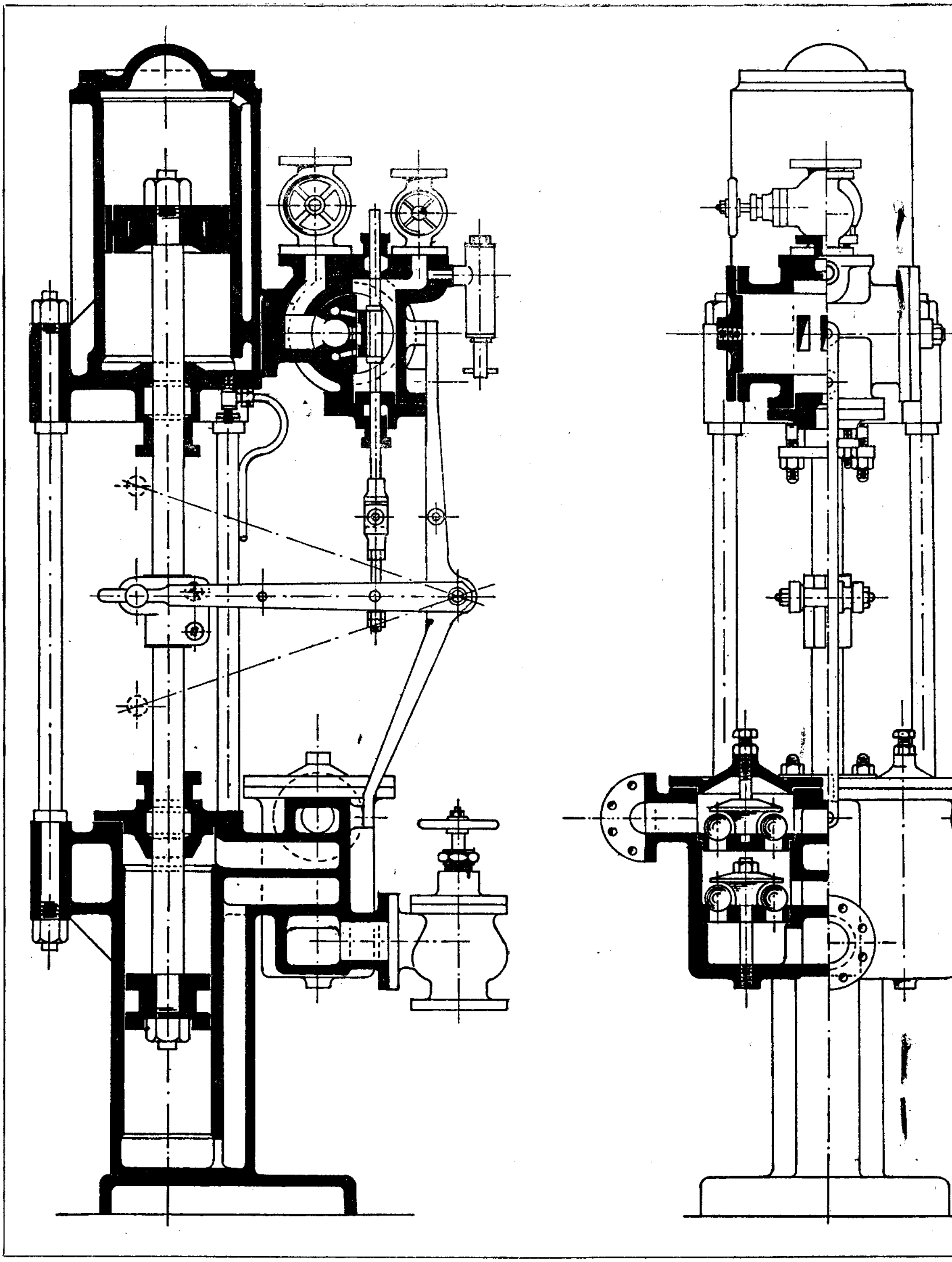
Attractive

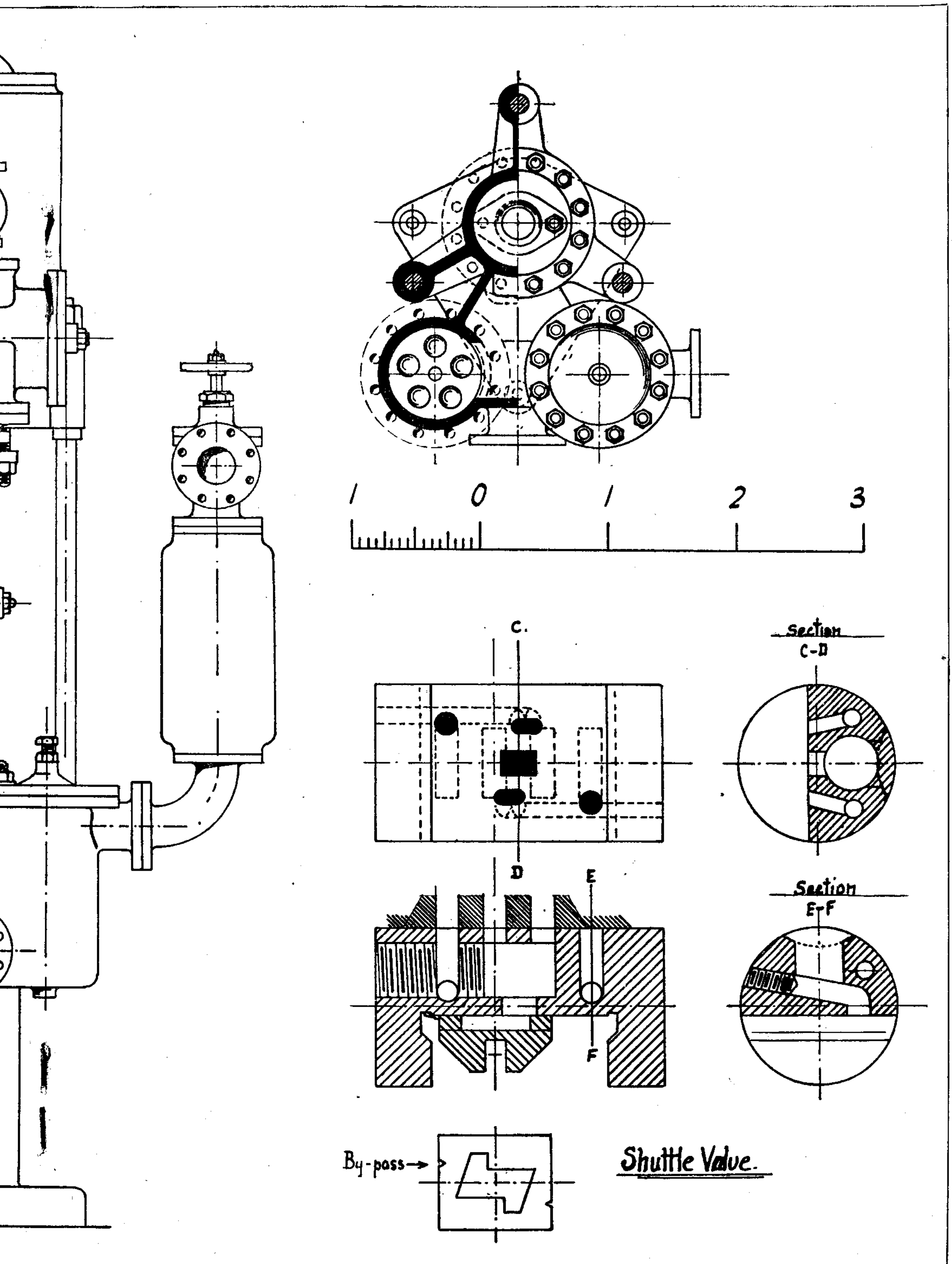
As the photographs and line drawings show, it makes quite an attractive little model, but I found it impossible to combine external fidelity to the original with efficient performance as a force pump. To me, this is a matter of little importance, as I only wanted a scale reproduction in appearance to operate under moderate air pressure; but I mention the fact in case anyone should think of building such a model in the hope of getting a powerful feed-pump. To achieve this, the water end of the pump would have to be so modified to reduce internal clearance spaces and stream-line water passages, etc., that the final result would no longer bear much resemblance to its prototype.

Building the model occupied rather over 12 months of my spare time, roughly some 400 working hours; and some liberties, of course, though mainly internal ones, have been taken with the manufacturers' design in the interests of simplification and adaptation to small size. For instance, balls were substituted for the nests of spring-loaded suction and delivery mitre valves, etc. In external features the shuttle valve-chest is somewhat larger than scale size. The prototype has a shuttle of 5 in. diameter, and while I don't think it would have been beyond me to have modelled it to $\frac{7}{16}$ in. diameter, I doubted whether so small a valve would pass enough compressed air at about 20 lb. pressure to operate the pump successfully, so it has been increased to $\frac{5}{8}$ in. which meant enlarging the casing.

By-passes

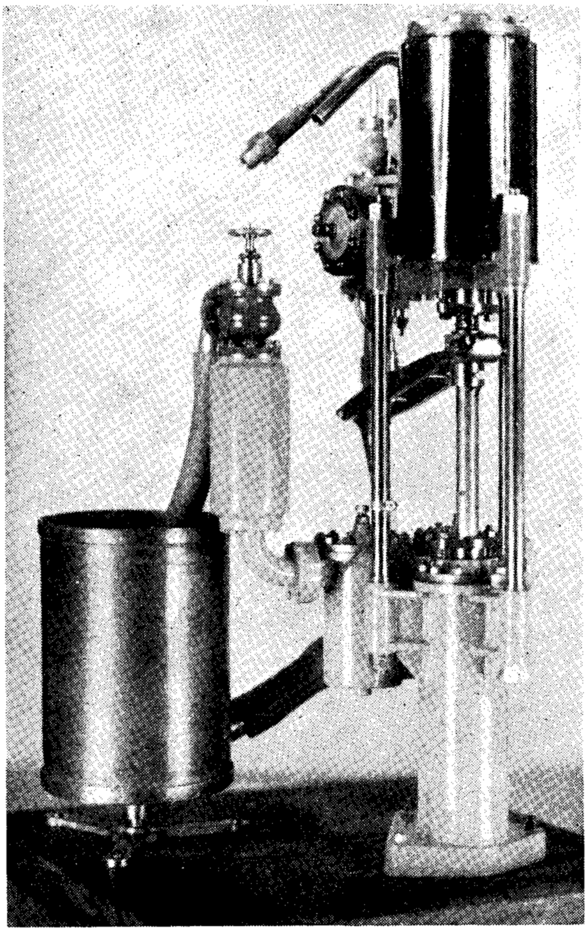
Readers familiar with the Weir pump will also notice that the by-pass bells are missing from the shuttle valve-chest. I thought them an unnecessary complication and only likely to increase friction or leakage, or both. In place of them, permanent by-passes have been arranged




1
0
1
2
3
C.
D
E
F
Section
C-D
Section
E-F
By-pass
Shuttle Valve.

for by means of the little V-nicks to be seen in the sides of the control valve drawing. Their only drawback is that steam, if used to drive the pump, could not be used expansively, a very minor matter.

The shuttle-valve is shown in the drawing to a larger scale. Though simplified in construction, and withal rather a tricky thing to make (I spoilt two before I got one just right) it is in essentials a precise copy of the actual valve used on these pumps and, though it may look intricate, it is really no more than a steam reciprocated circular slide-valve having a central flat face on which a small control valve driven by the pump levers is moved up or down at each end of the pump stroke. In the model, on account of the by-pass nicks, this control valve does no more than operate the shuttle by opening the ends of the casing alternately to steam and exhaust through the tiny passages drilled in the body of the shuttle on either side of the main ports. In the full size pump, it would also perform the functions of cut-off and cushioning.



Rear view

Testing

The valve casing is built up of gunmetal, and the shuttle-valve has to be lapped to a nice and fairly steam-tight fit; and here I ran into trouble when I came to test the model. I had spoilt two shuttles in the making and happened to have used up in the process all the gunmetal I had by me of a suitable size; so I made the third shuttle-valve of a piece of hard bronze. It turned out a beauty and worked very well under compressed air—but—when tried out under steam nothing would induce the pump to kick, and I found that the bronze shuttle has a slightly higher coefficient of expansion than the gunmetal casing, just enough to cause it to stick too tight for the steam to throw it over. I decided to let well alone; it will ease itself in time sufficiently to give it another steam trial, I have no doubt.

The principal dimensions are—steam cylinder 1 in. diameter; pump barrel, $\frac{11}{16}$ in. diameter; stroke $1\frac{3}{4}$ in.; shuttle-valve, $\frac{5}{8}$ in. diameter; maximum stroke 5/32 in. The shuttle stroke can be adjusted, by means of stop plugs in the casing covers, to the best working position. The steam piston is fitted with a solid floating ring lapped to the cylinder bore and having a few trap grooves turned in it. The pump-rod is of ground rustless steel, $\frac{1}{4}$ in. diameter.

No castings are used, the three main components and the stop valves are built up of pieces of gunmetal carefully shaped, fitted and, where necessary, pinned together and silver-soldered with "Easy-flo." The steam cylinder block is composed of ten such pieces, the valve chest of seven and the pump barrel and valve chamber assembly of sixteen. The last mentioned is a decidedly complicated structure, and was rather a troublesome soldering job; eventually, I found a few pinholes which had to be made good with soft solder. All other parts are made from rod and sheet material.

Alterations

Since the line-drawing was made, a few alterations have been made to try to improve performance, but without very much effect. The most useful one was the removal of the shut-off valve on the suction inlet. Inserted for the sake of appearance only, it certainly did obstruct water flow. The suction-valve nests have also been altered to give larger inlet area and the pump bucket has been replaced experimentally by two opposed cup-leathers.

A $3\frac{1}{2}$-in. Gauge L.M.S. Class 5 Loco.

by "L.B.S.C."

WELL, here we are—all-present-and-correct-sergeant! A nearly-worn-out locomotive can't sprint along the level road at 100 miles per hour, and take banks in its stride; and your humble servant being in the same category, naturally it takes a bit more time than of yore, to get out a drawing and details for a guaranteed job. Still, you know the old saying about everything coming to those who wait! In offering the reproduced drawings, I thought that it would be as well to include enough detail to allow builders of "Doris"—and they are many—to get a good kick-off on the tender job. As I have already given a fair bit of detailed information about the tenders for the "Maid of Kent" and the "Minx," and the tender for "Doris" differs only in size and minor details, it shouldn't be necessary to recapitulate the whole rigmarole; so I will deal briefly with the general construction, and then you can go right ahead and get on with it.

Frames and Beams

Two pieces of ordinary soft blue steel, $17\frac{1}{4}$ in. long, and $2\frac{1}{2}$ in. wide, will be needed for the frames. There is no need to make tender frames as thick as engine frames, as they only have to carry a light load, and there are no traction stresses to withstand, as in the case of engine frames; so 13-gauge (3/32-in.) material will do fine. Mark one out, drill a couple of the screwholes, temporarily rivet the plates together, and get busy with hacksaw and file. Leave a weeny radius at the top of the axlebox openings as shown. An Abrafile will make short work of the arch-shaped openings, only be sure that you keep well within the marked line. These bits of rough wire cut so jolly quickly that you are over the border before you realise it. Incidentally, I tried one in my Driver jig-saw, in place of the usual blade, when I ran out of blades, but it wasn't a success, as the machine ran much too fast for it. The only way to slow it down, would be to install a geared motor, but then it would be too slow for sawing brass and copper, which I mostly use it for.

A 4-in. length of $\frac{1}{4}$-in. by $\frac{1}{16}$-in. angle, either brass or steel, is riveted flush with the top, on the inside of each frame, as shown in the illustration. Since my "Diacro" bending brake came home, I have utilised small bits of 16-gauge steel for making short lengths of steel angle, to be used in place of the extruded brass hitherto specified for these jobs; and as the machine makes perfect angles, equal or unequal, in a few seconds, there is considerable saving both of time and cost, not to mention utilising material otherwise scrap.

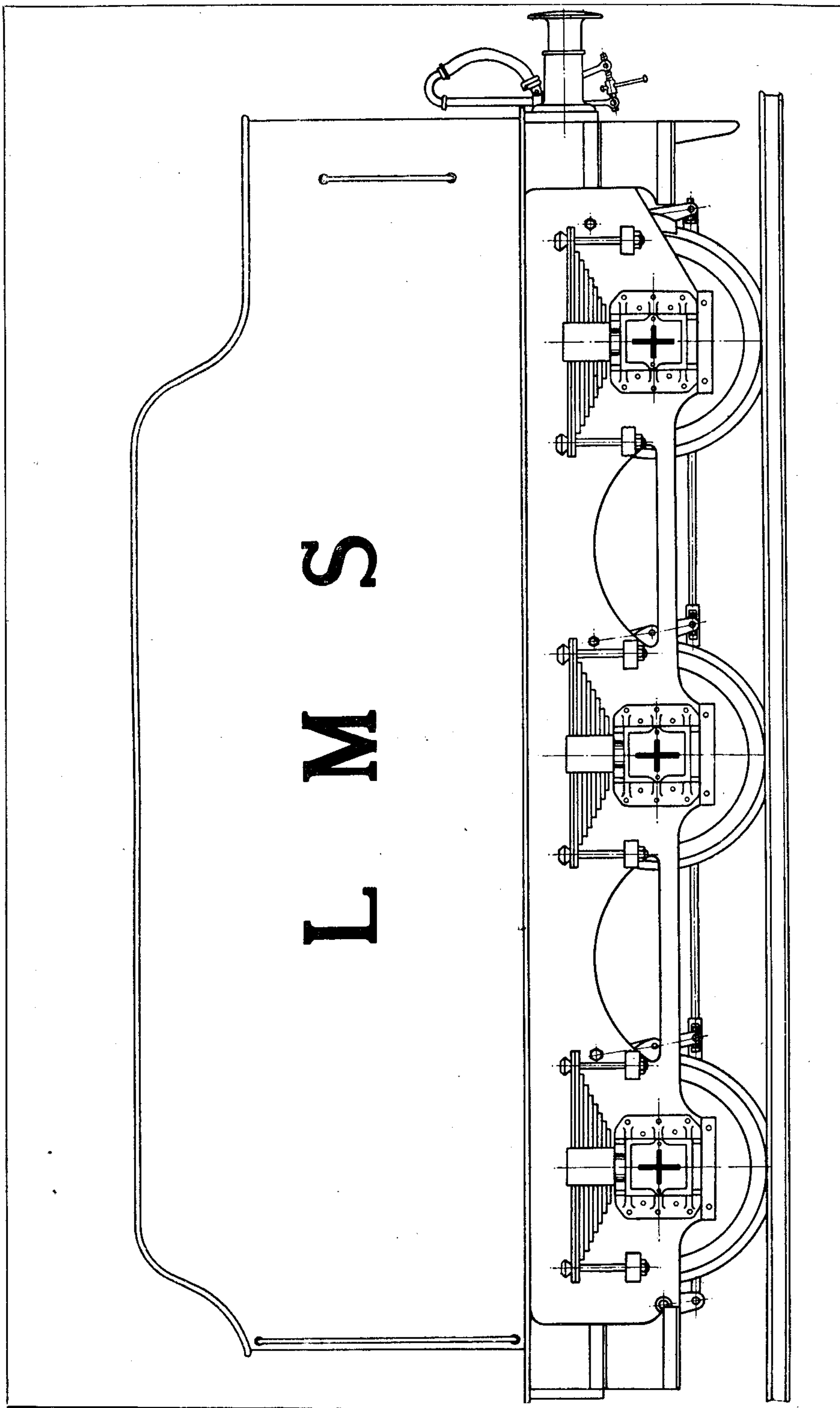
A separate detailed sketch is given, of the horncheeks. Our advertisers who supply "approved" castings, will be able to do the needful, and the horncheeks are machined and fitted, exactly as described for "Maid" and "Minx," so there is no need for repetition. Use $\frac{1}{16}$-in. charcoal-iron rivets, or soft steel rivets if you prefer them, resting their heads in a cupped dolly, made as previously described. Countersink the rivet holes on the inside of frame, and after hammering down the rivet shanks, file off flush.

The beams are made same as the engine beams, from the same kind of material. Note, the frame slots are only 3/32 in. wide, and the inner edges are $4\frac{1}{2}$ in. apart. The drag-beam has square corners, but the buffer-beam has the corners filed off; in full size, this allows the engine to clear lineside obstructions when going around a curve sharp enough to cause considerable overhang. As the holes for the buffer-shanks foul the side frames, nuts cannot be used to fix them; so instead of drilling clearing holes in the beam, tap them $\frac{3}{8}$ in. by 32. The special buffers for these will be described later; let's see to the most important things first. There was once a club member who was always talking about the splendid $3\frac{1}{2}$-in. gauge locomotive he was building, but nobody ever saw any sign of it; and at last he was challenged to prove that he actually *was* building one, by bringing along the pieces. He solemnly produced the front draw-hook at the next meeting!

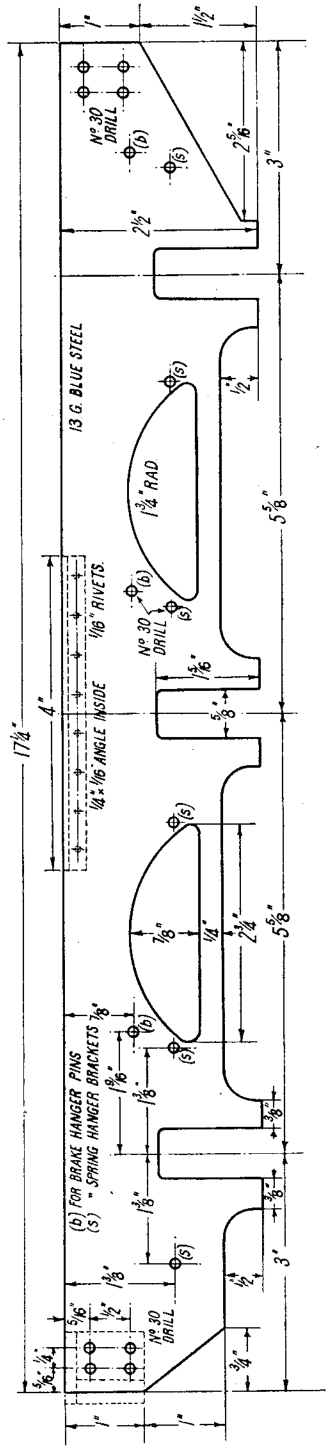
The frames may be attached to the beams either by angles, screws, and rivets, as shown, or by brazing or Sifbronzing the frames into the slots, in which case no angles are needed. I always Sifbronze mine now, with temporary distance-pieces between the frames, and clamps outside, to maintain the whole issue true and square under the heat; the process has been fully described. Many full-sized tender frames are now made up by welding, so once again big practice is following small; yet when I first started in to make brazed or bronze-welded frame assemblies, I was derided by the board of directors of Messrs. Knowitall & Co. Unlimited, on the grounds that this method of construction was "not a real engineering job!!" Well, I guess that time proves all things. Beginners, don't forget, before putting the screws in, or applying the blowlamp or blowpipe, to level up the frames on the lathe bed, or something equally flat, and check the beams to see if they are square with the frames. There must be no suspicion of "chair-with-a-short-leg" effect when the whole lot is permanently assembled.

Axleboxes and Springs

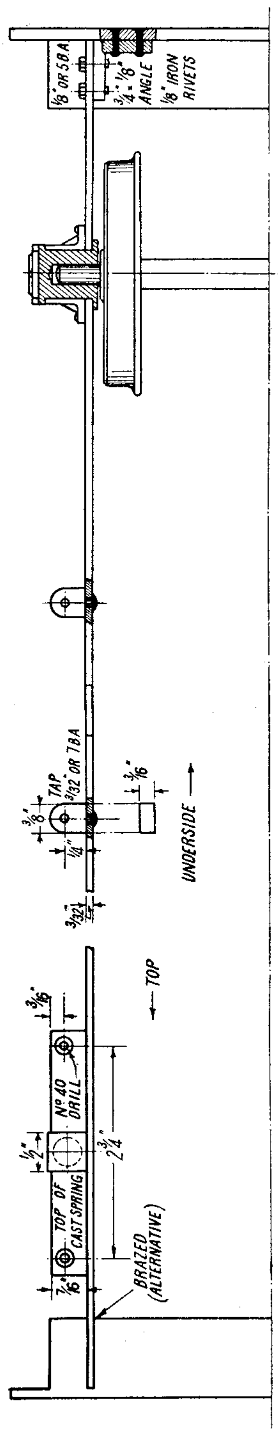
Our "approved" advertisers will probably supply the whole set of axleboxes cast in a stick. This will probably be too long for the side grooves to be milled out at one fell swoop, on the average home-workshop lathe; but if you have



Side elevation of tender for "Doris"

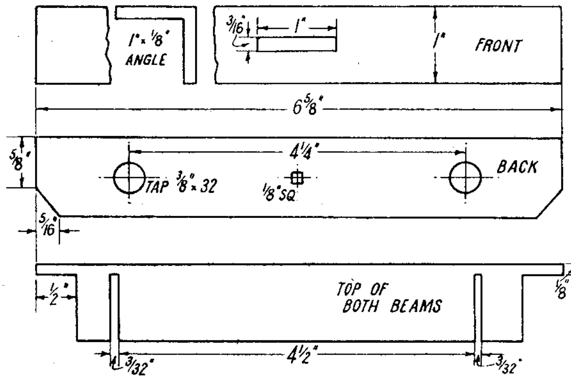


Dimensioned details of the tender frame



Some details of frame assembly

the needful, go right ahead. Otherwise, saw the stick in two, and perform on each half separately, same as described for main boxes, or the tender axleboxes for "Maid" and "Minx." Have them an easy sliding fit in the hornchecks. Either part the boxes off the stick by holding same in the four-jaw chuck and using an ordinary parting-tool, or saw them off, chuck each in the four-jaw, and face the ends with a round-nose tool set crosswise in the rest. The backs can be



Buffer and drag beams

smoothed off with a file; cast fronts shouldn't need touching.

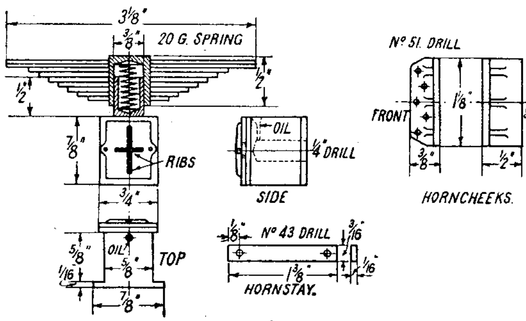
Mark off the axle holes, centre-popping the middle of the back; and if you haven't a machine-vice to hold them whilst drilling, chuck each box in the four-jaw, with the pop-mark running truly, and use a drill in the tailstock chuck. The holes *must* be true and fair with the sides and back of the box. Don't forget the weeny oil holes!

If you can't get castings, use bar material of $\frac{3}{4}$-in. by $\frac{7}{8}$-in. section, and machine it same as the stick of cast boxes. Alternatively, if anybody wants to dodge the milling process, they can, by making the boxes from $\frac{5}{8}$-in. square rod, with separate front face and back flange cut from 16-gauge sheet brass, and either silver-soldered on, or screwed and soft-soldered. The ornamental twiddley-bits can be cut from sheet, and screwed and soldered on likewise. If rod material is used, it should be good-quality brass, bronze or gunmetal, otherwise excessive wear will take place. If only soft stuff like "screw-rod" is available it can be used if the journal holes are bushed with gunmetal or bronze, as specified in similar case for "Maid" and "Minx."

The springs may either be the usual castings with a plunger in the hoop, or real working leaf-springs. In the former case, the plungers and springs are fitted as described for the 5-in. gauge jobs, but to the sizes shown here. If working leaf-springs are desired, they are best made up on Tom Glazebrook's system of "laminated plates," thin spring steel of about 26-gauge being used for the laminations, about three thicknesses being needed for each "plate" in the spring. A hoop or buckle is easily made, as shown in the detail sketch, from $\frac{1}{2}$-in. square rod; I have shown it tapped 5/32 in. by 40 for a grub screw, to clamp the nest of plates, but if you can get hold of a small Allen screw, use it, and tap the hole to suit. The holes in the top plates, for the spring pins, are punched on a block of lead with an ordinary flat-ended punch, tapered back behind the business end for $\frac{1}{2}$ in. or so. You can make it in a few minutes from 3 in. of $\frac{1}{4}$-in. round silver-steel, by process previously described.

The spring pins for both cast and working springs are merely $1\frac{1}{4}$-in. lengths of 3/32-in. round steel, screwed 3/32 in. or 7-B.A. at both ends. On the upper end of each, screw a $\frac{3}{16}$-in. length of $\frac{1}{4}$-in. round rod; chuck the pin in the three-jaw, and turn the head to the shape shown. The lower ends are screwed into tapped holes in lugs riveted into the holes in the frame, provided for that purpose. To make the lugs chuck a piece of $\frac{3}{8}$-in. by $\frac{3}{16}$-in. mild-steel in four-jaw, set to run truly, and turn a $\frac{1}{8}$-in. pip on the end, $\frac{3}{16}$ in. long; part off at a full $\frac{3}{16}$ in. from the shoulder. Drill a No. 48 hole $\frac{1}{4}$ in. from the shoulder, tap 3/32 in. or 7 B.A., and round off the end. Make a dozen of them, poke the shanks through the holes in the frame marked (s), and rivet over on the inside. When the springs are placed in position over the axleboxes, the spring pins are pushed through the holes in the top leaves, screwed through the lugs, and lock-nutted underneath with ordinary commercial nuts; the assembly can be seen in the general arrangement drawing.

The hornstays are $1\frac{3}{8}$-in. lengths of $\frac{1}{16}$-in. by $\frac{3}{16}$-in. steel strip, with a No. 43 hole drilled $\frac{1}{8}$ in. from each end, and are attached to the frames by



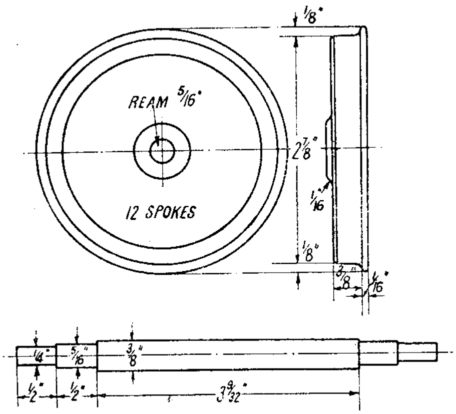
Axlebox and spring details

8-B.A. screws running through the holes in the stays, into tapped holes in the frame. Use No. 51 drill for 8-B.A. tap, and roundhead screws for preference.

Wheels and Axles

The wheels are finished to $2\frac{7}{8}$ in. diameter on tread, and should have 12 spokes; the hole for the axle is reamed $\frac{5}{16}$ in. They are turned in exactly the same way as the engine wheels, so I needn't waste space by repeating how the opera-

tion is done ; beginners should be careful to have a nice even radius between tread and flange, and to round off the flange as shown. I have seen an engine which cost a three-figure price, with a sharp angle between tread and flange, and the flange itself not rounded off at all. When running,

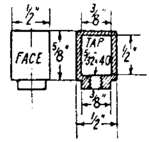


Wheels and axles

the sharp edge of the flange bore hard against the outer railhead on the curves, and simply cut slices clean off, the action being exactly the same as the blade of a shear. On my own road, after thirteen years of heavy traffic, the inner edges of the outer rails on both curves show very little sign of wear, the top edge on the inside of the rail just looking as though a smooth roller had been pressed against it. This is how is should be.

Three pieces of $\frac{3}{8}$-in. round mild-steel, a full $5\frac{5}{16}$ in. long, are needed for the axles. Chuck in three-jaw, face the end, turn down 1 in. length to a full $\frac{5}{16}$ in. diameter, then further reduce the end for another $\frac{1}{2}$ in. to a bare $\frac{1}{4}$ in. diameter. Use an axlebox for a gauge, and when it slides easily on the end of the axle, the diameter is O.K.

Buckle or hoop for working leaf springs



Take off the sharp edge, or round off the end completely, if you like. Then turn down the $\frac{5}{16}$-in. part to a press-fit in the wheel, or turn until it just won't enter, then ease with a file until it does, whichever your skill will permit. As the journal and wheel seat are both turned at the same setting, the wheel will run truly, even if the chuck should happen to be a few thousandths of an inch out of truth.

All the wheels can be pressed home right away, as the axleboxes are outside the wheels ; then put a pair of boxes on the ends of each axle, drop them in place, with the frame assembly upside down on the bench, and put the hornstays on. The wheels should spin freely, and run without any sign of wobble, in any position of the axleboxes ; and if the chassis is pushed along the floor, it should run in a straight line, and not go wandering about to right or left. If it *does* wander, the axles are not square across the frame, and you'll get flange friction. Next stage—tender body.

Petrol Engine Topics

(*Continued from page* 758)

latter is very much simplified, and the final result is at least just as satisfactory, providing that accuracy is observed in all the machining operations.

Even so, I anticipate that some constructors will have complaints to make regarding the difficulties in this respect, but I can only say that I have been unable to think of any ways in which the job could have been made easier. If my readers demand designs for tiny engines of intricate type (as they invariably do), they must expect to have to devote care and skill to their construction. Every operation has been carefully planned, and considerable pains taken, both on the drawing board and in the workshop, to reduce procedure to its simplest terms. Innumerable readers, in many cases raw beginners, have succeeded in building successful engines to my designs by following the methods described, and the worst failures have been those produced by contructors who do not observe the necessary care in marking out, setting up and machining, or who try to adopt short cuts in these operations.

Many readers, including some who are not actively interested in building the particular types of engines described, or even any type of internal combustion engines, have experssed appreciation of the way in which machining problems are dealt with in these articles. Hardly a week passes but one or two letters are received commenting on these " interesting machining jobs " and asking for more ; so it is clear that even if nobody ever built engines to the actual designs, the space occupied in describing them in THE MODEL ENGINEER would not be wasted. But I know, on the strength of evidence found when visiting model engineering societies all over the country, that many readers do build the engines, with highly successful results.

(*To be continued*)

The Design and Construction of Small Power Transformers

by A. R. Turpin

THE amateur is finding today more and more uses for small power transformers in his workshop. He may use them for the electrification of a model railway, battery charging, instantaneous soldering-irons, spot- and arc-welding, running low-voltage " surplus " motors, operation of door chimes, and magnetisation of small permanent magnets.

The *accurate* design of a transformer is not an easy or simple matter, as so much has to be assumed from previous experience ; for instance, one of the first things the designer has to know is the efficiency, but before he can find that out, he has to design his transformer. It is rather like the story of the hen and the egg—which comes first ?

On the other hand, provided that we are not particular, and that the finished transformer may be within 5 per cent. of the output and efficiency required, and we are working on an input of 200/240 V 50 cycles, then the design of such a transformer is a comparatively simple matter.

To commence, we will assume the following efficiencies for different power outputs : 10 to 50 W, 80 per cent. ; 75 to 150 W, 85 per cent. ; 200 to 500 W, 90 per cent. For transformers having high voltage multi-winding secondaries as in radio types, these efficiencies are likely to be lower. The actual output efficiencies are likely to vary by as much as 5 per cent. from the above figures even for low-voltage secondaries, as so much depends on the accuracy of the winding, and finding an exactly correct shaped core stamping to fit the winding—an almost impossible task unless it is specially made to suit the design—so to meet this variation a plus and minus tapping of 5 per cent. should be arranged on the primary winding.

It should also be remembered that in these days of power cuts, the input voltage is likely to vary by quite this amount. So bearing these points in mind we can commence on the design of our transformer.

(1) Decide on the output required. $V \times A = W$.

(2) Decide on efficiency likely to be obtained.

(3) Find actual primary W from $Wp = \dfrac{\text{Secondary W} \times 100}{\text{Efficiency per cent.}}$

(4) Find required core cross section area from $A = \dfrac{\sqrt{Wp}}{5.75}$

By core area we mean " X " × " Y," Fig. 1.

(5) Find the turns per V from $TPV = \dfrac{8}{A}$. By turns per V we mean the number of turns of wire round the core for every V of input and output.

(6) From a wire table find the nearest gauge of wire that will carry the required current at a density of 1,000 amps. per sq. in of cross section area.

(7) Find the approximate resistance of the secondary winding, by estimating the length and referring to the wire table, then ohms × amps. × TPV = compensating turns to be added to secondary winding.

(8) From the same table, estimate space taken by primary and secondary windings, plus insulation and bobbin. The figures in the table apply to machine winding, and at least 50 per cent. should be added for hand winding. Even if machine wound on the lathe, the beginner is advised to make some allowance for unskilled work, because nothing can be done about a bobbin and winding space that turns out to be too small, and very little is lost if too much space has been allowed. Thus, is a transformer designed in eight movements.

Some readers may wish to know what will be the effect of variations in the above method of design, and some are mentioned below.

The cross section area of the core may be increased or decreased in size provided the TPV are altered in inverse proportion. A smaller core area will then result in giving a greater temperature rise, increased copper losses, poorer voltage regulation and smaller size. Increased core area will give better cooling, higher iron losses, reduced copper losses, better voltage control and increased size, and usually, increased cost. The gauge of wire used for each winding may be reduced considerably with increased copper losses, poorer voltage control, and larger temperature rise.

Provided the transformer is in a well ventilated position, and a lower output voltage is permissible, the current density may usually be increased by as much as 300 per cent. on a 100 W. transformer without exceeding a temperature rise of 50 deg. C.

In the case of certain instrument transformers, and those used for spot-welding and magnetisation of small magnets where the output volts are small and the currents high, it is as well to reduce the TPV to unity or less, owing to the difficulty of winding conductors of very large cross section area.

Auto-transformers, that is, a transformer in which the secondary winding is merely a tapping taken off the primary winding, is calculated in the same way as the ordinary type, except that that portion of the wire common to both windings may be of reduced gauge because the current carried by it will be equal to the difference of the currents in the two windings.

By the way, this type of transformer should never be used when the secondary is connected to bare conductors, as in welding; and whilst on the subject of safety, it is advisable to wind the primary and secondary on separate bobbins to guard against the slightest chance of insulation breakdown when used with a garden railway, or in like circumstances. The chance of a fatal shock is so much greater when standing on wet

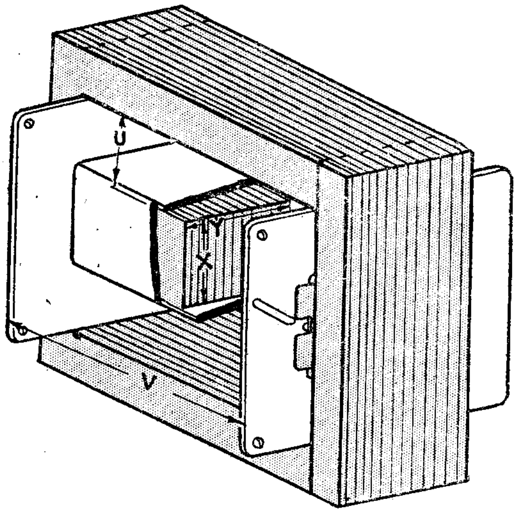


Fig. 1. Showing the dimensions required for calculating a design

grass, or damp earth, as compared with a dry wooden floor.

Let us now consider a numerical example of design. Let us suppose that we wish to build a universal transformer capable of supplying motive power to most types of government surplus low-voltage motors that are at present available to the public—we refer, of course, to those motors suitable for a.c. operation.

For this purpose we shall require four separate secondary windings of 8 V, 5 A each, so that by connecting these windings in series or parallel we shall be able to obtain the following outputs: 8 V 20 A, 16 V 10 A, 24 V 5 A, or 32 V 5 A.

Eight volts has been chosen because it usually takes an increase in volts of one third or more to fully load a motor using alternating current supply, as compared to direct current. Thus a motor rated at 24 V d.c. can be safely used on 32 V a.c., and in some cases up to 40 V.

So let us commence on the design:

(1) Our total full load output will be $32 \times 5 = 160$ W.

(2) Our efficiency is likely to be about 90 per cent., so $\frac{160 \times 100}{90} = 177$ W.

(3) Core cross section area will be $\frac{\sqrt{177}}{5.75} = 2.3$ sq. in. approx.

(4) Turns per volt $= \frac{8}{2.3} = 3\frac{1}{2}$ approx.

(5) Primary current $= \frac{177}{240} = 0.74$ A approx.
Nearest gauge of wire at 1,000 A per sq. in. of cross section = 21 s.w.g.
The secondary winding will require 14 s.w.g. wire to carry the 5 A, and it is as well to use d.c.c. wire for gauges above No. 18 so we will do so in this case.

(6) We can only assume the number of compensating turns to be added to the secondary, and assuming a voltage drop of just over one volt, this will give us four turns, or one turn per section, which is the least number that we can add.

(7) The total primary turns will be (240×3.5) plus 5 per cent. for the plus tapping, making 882 turns in all.
The total secondary turns will be (32×3.5) plus 4 compensating turns, 116 turns in all.

(8) We now have to find the size and shape of the core stampings required. "Y" Fig. 1 should preferably be about 1.25 to 1.5 times "X", and if we take the latter "X" could be 1.25 in., and "Y" 1.8 in., which will give us approximately 2.3 sq. in. core cross section area.

To find the window space required, "U," "V" Fig. 1, we must first find the space taken by each winding. Twenty s.w.g. winds 865 turns per sq. in., so the primary winding will require $\frac{882}{865}$ sq. in., say 1.1. The secondary will be $\frac{116}{115}$ say 1.0 sq. in., making 2.1 sq. in. in all; but to this figure must be added the space for the bobbin and insulating material, a further

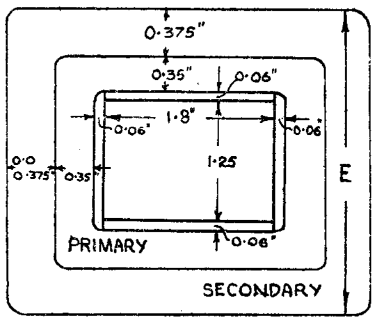


Fig. 2. How dimensions of bobbin are fixed

50 per cent. making, say, 3.1 in. in all. And now our troubles commence.

It may be that we cannot get 21-gauge wire, so we must substitute 22 s.w.g. We then find a stamping that will give us the core area we want, but has not sufficient window space; so we either have to try to squeeze things in by reducing the secondary gauge, or, preferably, take the next largest stamping.

However, when we come to wind the secondary we may find we just cannot wind each section in one layer, and to make a tapping at a midpoint makes an untidy job, and will take up a

lot of space; so we have another look, and try to find a stamping with a longer window space, and then may find another snag. With a little perseverance, we shall eventually find a stamping that will, with some modification to the design, suit our particular job. Of course, the commercial firms are lucky because they are producing sufficient transformers of one type to make it worth while having special stampings cut to fit their windings exactly. But my only advice is, that if you have to make a choice of making the transformer larger or smaller, always make it larger if you can; and whichever you may do, our 5 per cent. plus and minus tapping on the primary is almost certain to look after any

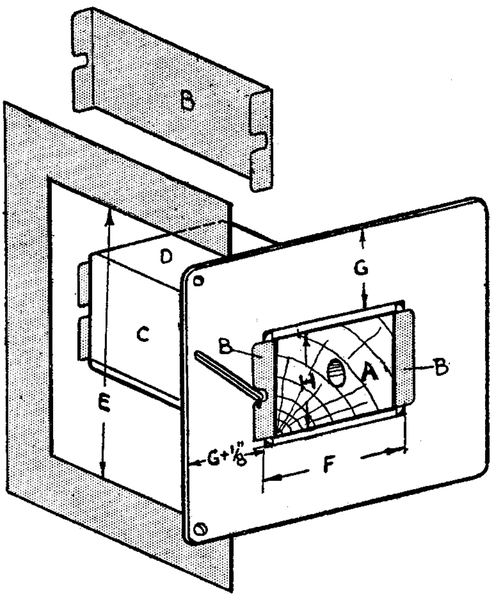


Fig. 3. Shows construction of bobbin with one cheek in position, and relation of cheek size to the "U"-shaped stamping

variation in efficiency, unless the alteration to the design is very large.

We can now make a drawing as Fig. 2 of our core, and from that design the bobbin, and work out the amount of wire required for the primary and secondary windings, and from the latter ascertain the copper loss and check up to see if the number of compensating turns that we allowed were correct.

The distance between the bobbin cheeks is $3\frac{1}{16}$ in., and in this length we can wind 92 turns of 21 s.w.g. enamelled wire, and we shall require 9.5 layers or a depth of 0.35 in. for the complete primary winding plus insulation. The average length of a primary turn will be $2(2.0 + 0.35) + 2(1.37 + 0.35) = 8.1$ in. then, $\frac{8.1 \times 882}{36} = 254$ yd.

The secondary winding will require 4 layers of 29 turns, having a depth of 0.375 in., this winding being wound on top of the secondary will have an average turn of a length of $2(2.0 + 0.75) + 2(1.37 + 0.75) = 9.74$ in. then, $\frac{116 \times 9.74}{36}$ = say, 31 yd. The resistance of 31 yd. of 14 s.w.g. wire is 0.145 ohms, then the voltage drop is $0.145 \times 5 = 0.76$ V, and we allowed 1 V which must be near enough, as we cannot add half turns to a section.

Construction

The first thing to do is to stack up your stampings, clamp them in the vice and carefully check up the length, width, and thickness of the core, and then make wooden replica of the centre section a few thous. larger all round, and 1/64 in. shorter, then drill a ⅜-in. hole right through the centre of it, "A" Fig. 3.

Take two of the T-shaped stampings and cut off the two short arms, and bend the ends of them up to form a shallow "U" the exact length of the wooden core, "B" Fig. 3. Obtain some $\frac{1}{16}$-in. paxolin or similar laminated plastic, and cut four strips so that they form a box round the core and the bent metal strips (see "C" and "D" Fig. 3). Note that it is the "C" strips that overlap the edges of the "D" ones, and not vice-versa; this is important, because, when the wooden core is withdrawn, the "D" strips are prevented collapsing by the thickness of the bent metal locking-pieces, "B"

Now cut out two paxolin squares for the cheeks of the bobbin, one dimension of which will be the same as the inside measurement of the U-shaped stampings, i.e., "E" Fig. 3, and the other will be "E," minus "H," plus "F," plus about 10 per cent. to accommodate the tappings and joints, which should come on these two sides. Either cut a slot, or drill a number of holes, as shown, in the cheeks to accommodate the tappings, and you can also drill some holes in the corners if you wish to utilise the cheeks as a terminal block as well. Cut out a square hole to accommodate the boxed-in core, taking great care that the hole is truly central and a good fit. Remove the wooden core and rebuild it again with the cheeks in position.

It will be seen from this method of building up the bobbin that once the first layer of wire has been wound on, all pieces of the bobbin are locked firmly in place and cannot collapse. The usual method of using some kind of adhesive and relying on this to hold the parts of the bobbin together is very unreliable, as it is difficult to find anything that will make a really strong joint when using these resin-bonded laminated sheets.

The next items are two plywood reinforcing cheeks, and these are shown in photo No. 1. They are the same size as the bobbin cheeks, but have a ⅜-in. hole drilled in the centre and a piece cut out of the sides so that the tappings may be brought out.

We can now assemble the bobbin on a ⅜-in. bolt, sandwiching the bobbin between the two reinforcing pieces of ply, and securing the whole with a nut and washer screwed up hard. About 1½ in. of bolt should protrude, as this will be used for chucking the bobbin in the lathe for winding.

To wind the bobbin in the lathe, set as for screw-cutting a thread of the same pitch as the

gauge of wire you wish to wind. If you cannot do this exactly, set it to the nearest pitch available, but of a lower number. For instance, if you wish to wind 24 s.w.g. enamelled wire which winds 42 turns per in. and you only have change wheels that will give you 40, or 44, use the 40 pitch. With a little practice you will be able to make up the difference by a fractional turn of the cross slide every few revs. of the bobbin.

of waxed paper is then wound round this layer; this paper can often be obtained from a photographic friend or from the " blueprint " room of a drawing office; it is usually used for wrapping this type of material. The strip of waxed paper should be about $\frac{1}{8}$ in. wider than the bobbin and the edges serrated to a depth of $\frac{1}{8}$ in. at $\frac{1}{8}$ in. intervals. The greatest care should be taken that the end turns of one layer do not touch the

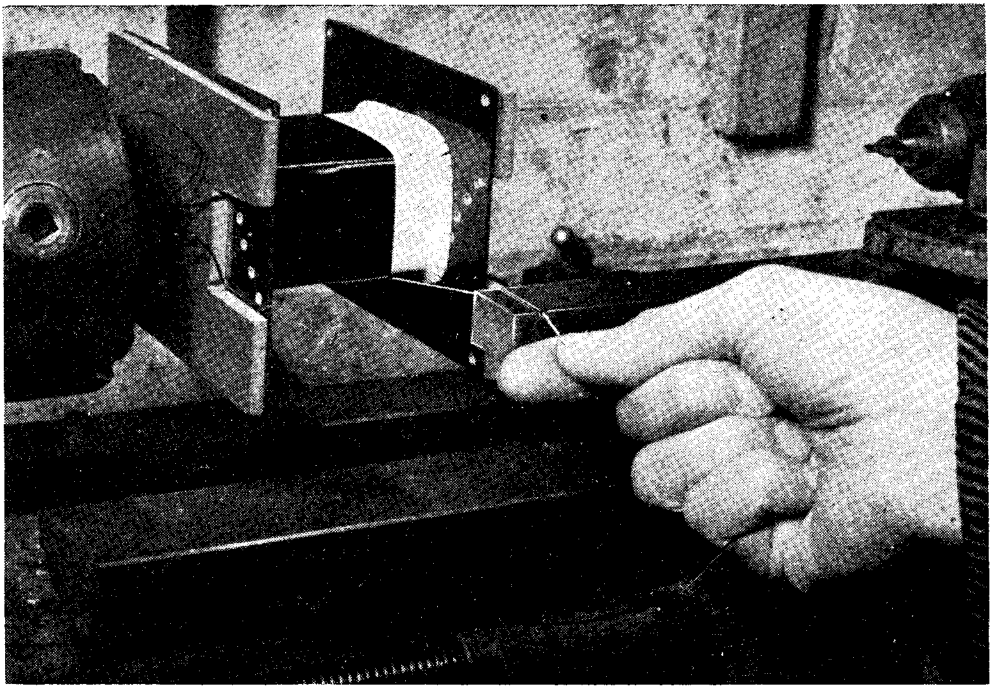


Photo No. 1. Showing method of winding a bobbin in the lathe

To feed the wire on, a set-up as shown in photograph No. 1 is used. This consists of a piece of wood held in the toolpost and having a saw-cut at the end of it to act as a wire guide. The reel of wire is placed on a rod held in a nearby vice and a slight tension kept on the wire by the fingers of the right or left hand. It is as well to set the lathe at its lowest possible speed, and in the case of a M.L.7, have the belt tension slack so that the chuck may be stopped at once by application of the hand; this last tip may prevent a lot of breaks in the wire for the beginner, or laboriously turning back and unwinding a large number of turns that have gone on unevenly. Great care should be taken at the commencement of a layer, and it is advisable to run in the first few turns of each layer by hand-turning of the chuck. When the first layer has been completed, the lathe is put in reverse and the backlash taken up on the leadscrew. A strip

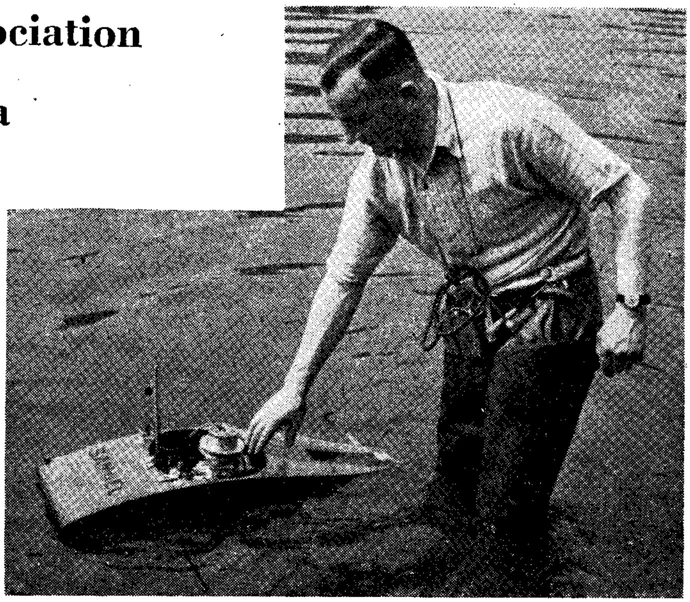
beginning of the layer below, because the greatest potential difference exists at this point.

Up to 30 s.w.g. wire, there is no need to join thicker wire to bring out as tappings, but above this gauge fine flex should be used. The fine wire should be soldered to the flex and the joint covered with oiled silk; the flex should be led right across the bobbin so that the subsequent turns wind over it: the flex can be temporarily held in place with a dab of Chatterton's compound. When making tappings in the middle of a layer, twist a loop in the wire and bring this out through the bobbin cheek, placing a strip of oiled silk over it to protect it from the following turns, unless it is very fine, when a flex lead should be used.

Having completed the primary, cover it with two or three thicknesses of empire tape, dependent on the voltages employed; this material should be of 0.004 in. thickness.

(*To be continued*)

The S.E. Association Regatta



Mr. W. H. Meageen with "Samuel"

PROMOTED by the South Eastern Association of Model Engineers and run under M.P.B.A. rules, a highly successful regatta was held at the boating lake, Brockwell Park, S.E., on Sunday, May 15th. The clubs represented were numerous and included Victoria, Blackheath, South London, Swindon, North London, Altrincham, Kingsmere, Orpington, Malden, Kent and Guildford.

There were events for all classes of boats, but in accordance with local regulations, the speed events were held in the morning period before 2 p.m., and the straight-running events in the afternoon.

The day commenced with a 500 yd. speed event for Class C (Restricted) hydroplanes. In this race Mr. Phillips (South London) with a new craft was an easy winner; powered by a 10 c.c. McCoy engine, it completed at 43 m.p.h. Other boats had difficulty in getting away, and second place went to one of the small Kingsmere boats.

1st M. Phillips (South London) .. 43 m.p.h.
2nd Mr. Hancock (Kingsmere) .. 21.5 m.p.h.

No "standard" Class C boats being present, the racing continued with a 500 yd. Class B race. In this race, speeds were generally lower and even Mr. Jutton's *Vesta II* failed to reproduce last season's form. A new craft of Mr. J. Lines (Orpington) shows promise, however, and may do better at some of the later regattas. Other boats in this event failed to get a complete run, and generally "beginning of the season" tantrums have not yet been ironed out.

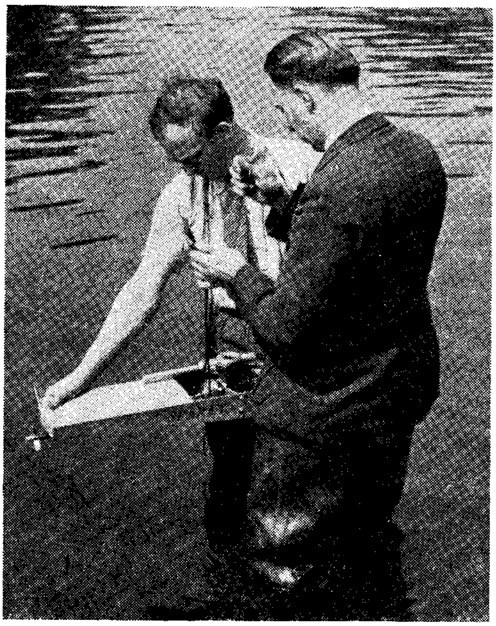
Results:

1st Mr. J. Jutton (Guildford)
Vesta II .. .. .. 35 m.p.h.
2nd Mr. G. Lines (Orpington)
Sparky .. .. .. 29.5 m.p.h.

The Class A event proved that non-starting is still one of the worst obstacles of round-the-pole racing, and none of the competitors succeeded in completing the course. The race was thus declared void.

Competitors of the calibre of Messrs. Meageen (Altrincham) and Parris (South London) both failed on their getaways and others failed to start at all! Mr. Meageen's boat, a new one, looks promising and will show improvement later, no doubt.

As this event was over somewhat early, the lunch interval was utilised by some of the unlucky Class A boats for experimental runs, and an unfortunate incident occurred when a nylon line was being tried out by Mr. Parris' boat *Wasp II*. The line stretched to such an extent that Mr. Parris was unable to get clear and was struck on the leg. Prompt first-aid revealed no



Another new boat, "Sparky," (15-c.c.) by Mr. G. A. Lines, which made a very promising run

serious injury but severe bruising. Mr. Parris was shaken by the accident and *Wasp's* hull was stove in at the front. It seems that nylon as a material for speed-boat lines is unsuitable, more so where heavy boats are concerned.

The afternoon was left to the steering boats and commenced with a nomination race across the lake. A good show of boats took part in this event, including Mr. Hood's *Truant* (Swindon), Mr. E. Vanner's *All Alone* and several new boats taking part in regattas for the first time. Mr. Rayman's steam launch *Yvette* (Blackheath) succeeded in returning a correct nomination for the 50 yd. course, an excellent performance.

The full result :

		Error per cent.
1st	Mr. A. Rayman (Blackheath) *Yvette*	Nil
2nd	Mr. B. Whiting (Orpington) *Ann* ..	4.5
3rd	Mr. Hood (Swindon) *Truant* ..	7.7

The same boats contested the steering competition which followed, and it proved a most interesting event to watch, as most of the craft were on form. Mr. Hood's *Truant* was the eventual winner, and a tie for second place between Messrs. Vanner and Benson had to be run off, the final result being as follows :

		pts.
1st	Mr. Hood (Swindon) *Truant*.. ..	8
2nd	Mr. Benson (Blackheath) *Comet* ..	7 + 2
3rd	Mr. Vanner (Victoria) *All Alone* ..	7 + 1

Mr. Phillips (left) starting his new 10-c.c. McCoy-engined boat

For the Bookshelf

Miniature Car Construction, by C. Posthumus. (London : Percival Marshall & Co. Ltd.) Price 7s. 6d. net.

Within recent years, the motor car has become popular as a subject for modelling, and quite apart from model racing cars—which, it is sometimes argued, are not true models at all—interest has been aroused in the construction of true scale miniature models, in which the essential features are fidelity of form and character to the original, as distinct from mechanical design and performance. The author is one of the best-known exponents of the construction of " solid " or non-working miniatures and here discloses the secrets of his technique, which include many highly ingenious methods and devices for facilitating operations on finicky details with simple equipment, and obtaining that " just-right " impression of realism. The interest of the book extends far beyond the specific subject and it should be useful to all who wish to build super-detail realistic scale models of any type.

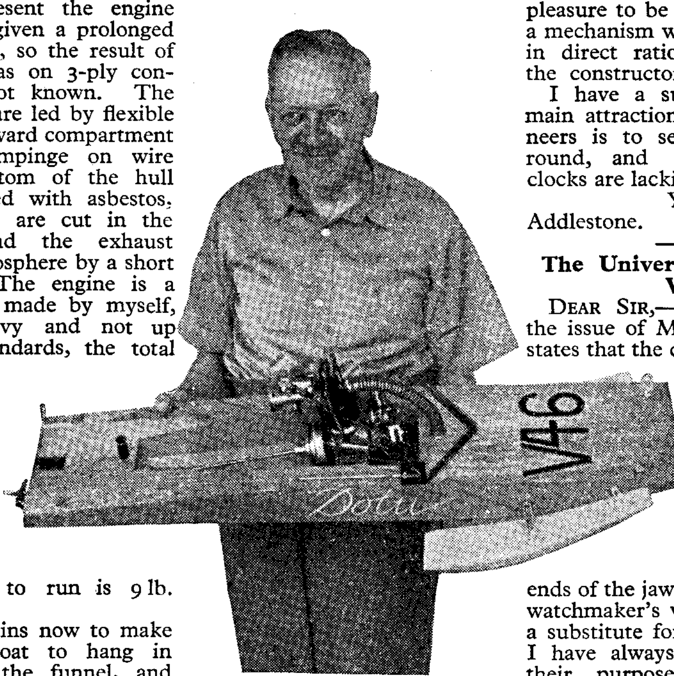
Electric Clocks and How to Make Them, by F. Hope-Jones. (London : Percival Marshall & Co. Ltd.) Price 10s. 6d. net.

Interest in the construction of electric clocks has always been strong among model engineers, many of whom have found this pursuit a very satisfying outlet for their talents, and well suited to their skill and resources. Many years ago, a handbook on electric clocks and chimes was published in THE MODEL ENGINEER series, and proved to be extremely popular ; so much so, that since it has been out of print, there have been incessant requests for its reintroduction. It was, however, felt that in view of modern developments in electric horology, something more than a reprint or revision of the original book was called for, and the present work, which, in addition to considerable entirely new material, contains one or two of the best examples of design taken from the earlier book, and others which have been described in THE MODEL ENGINEER in recent years, will undoubtedly be welcomed by enthusiasts as an up-to-date and comprehensive treatise on the subject. The preparation of the book has been carried out by a world authority—one might be so bold as to say *the* world authority—who has made a life study not only of the science of electric clocks, but also their construction in the simplest and most practical form. Among the items dealt with in the book, special mention may be made of the discussion on the horological researches of Galileo and Huyghens, the Hipp clock in various forms, auto-wind or remontoire systems, the Synchronome system, the free pendulum, rolling ball clocks, the Bulle clock, synchronous clocks, and striking and chiming gear. It is safe to say that never before has the constructional aspect of the electric clock been so fully or so ably presented.

PRACTICAL LETTERS

An "A" Class Speedboat

DEAR SIR,—The photograph reproduced herewith is or my latest "A" Class speedboat. It has been built to try out a principle. That is, to use the hull as a silencer. It is most effective, though at present the engine has not been given a prolonged full power test, so the result of hot exhaust gas on 3-ply construction is not known. The exhaust gases are led by flexible pipe to the forward compartment where they impinge on wire wool, the bottom of the hull being part-lined with asbestos, suitable baffles are cut in the bulkheads, and the exhaust escapes to atmosphere by a short funnel aft. The engine is a Stuart-Turner made by myself, is rather heavy and not up to modern standards, the total weight ready to run is 9 lb. 5 oz.



It only remains now to make a model lifeboat to hang in davits aft of the funnel, and wait for my friend Gems Suzor to come over from Paris in August to run it—Run *Dolin*, not the lifeboat.

Yours sincerely,

Virginia Water. RICHARD O. PORTER.

The "Eureka" Electric Clock

DEAR SIR,—I have followed with interest the correspondence on the above subject.

I think it is a shame to mislead model engineers into wasting their time by constructing such mechanisms. An analogy in a familiar field would be to mount the driving mechanism of a model locomotive on the tender and connect it to the driving wheels with string. The result would, no doubt, be interesting, but not a locomotive.

Crazy clockwork mechanisms seem to have the same fatal attraction for model engineers that perpetual motion has for some inventors. I do a little watch and clock repairing for amusement and occasionally to rescue a friend from the machinations of some so-called watchmaker. One can forgive the ordinary person for failure to distinguish between mechanism and fine mechanism but I am always shocked when a capable model engineer brings quite unabashed a popular—popular because of price—timekeeping device and is quite unable to see the difference between it and a real timepiece.

The primary purpose of a clock is to keep time and the more accurate the timekeeping the better the clock. The principles of accurate timekeeping have been known for many years. Starting from these principles, surely there is pleasure to be found in devising a mechanism which will perform in direct ratio to the skill of the constructor.

I have a suspicion that the main attraction for model engineers is to see the wheels go round, and properly-designed clocks are lacking in this respect.

Yours faithfully,

Addlestone. GEORGE SLAVIN.

The Universal Swivelling Vice

DEAR SIR,—On page 635 of the issue of May 26th, "Ned" states that the centre-pops on the ends of the jaws are to enable the watchmaker's vice to be used as a substitute for a depthing tool. I have always understood that their purpose was to serve as a support for the pointed end of a drill-stock which held a drill at the other end and was operated by a bow. The work was supported and pressure applied with one hand while the bow was operated by the other. Such means of drilling are rarely used today, since watchmaker's lathes and small sensitive drilling-machines have been introduced and almost universally adopted, though I have seen drilling carried out in the old manner in Clerkenwell during the past few years.

It might not be generally known that, until comparatively recent times, watchmakers had no lathe and most of their turning was done in "turns" consisting of a pair of dead centres adjustable along a bar which carries also a hand-rest. The work was supported on the centres and driven by means of the bow provided with a strand of horsehair which was passed round a pulley temporarily fastened to the work-piece.

It might be possible to utilise the two centres in the vice-jaws to obtain a rough depthing of a clock wheel and pinion; but they would, of course, be quite useless for watch work, for which purpose even the commercial depthing tools are usually insufficiently accurate as sold.

Whilst writing on horological matters, I would like to correct a statement made by "Watchmaker" in his letter published on April 7th. An uncompensated balance has a losing rate in

heat. An overcompensated balance has a gaining rate in heat, and to correct this condition the effectiveness or degree of compensation must be reduced by moving screws *away* from the free ends, *not* towards as stated in his letter. Furthermore, the temperature compensation of the balance will not be affected by moving any of the screws in or out, but only by shifting them towards or away from the free ends. Incidentally, the chief purpose of the compensation balance is not to correct errors caused by the expansion of the balance itself, but to counteract the weakening effect of heat on the hairspring. The error due to the loss of elasticity of the spring is about ten times as great as that due to expansion of the balance, and together they amount (for a clock or watch having a brass balance and steel spring) to about eleven seconds per day per degree Centigrade. (Approx. 7 sec./deg. F./day.) Thus a clock moved from a cool room at 40 deg. F. to a warm one at 75 deg. will lose four minutes per day due to the change of temperature alone.

Yours faithfully,
New Milton. GEO. H. THOMAS.

"Absentees"

DEAR SIR,—Whilst watching the regatta organised by the South Eastern Association of Model Engineers at Brockwell Park on May 15th last, I was reminded of Mr. Westbury's recent article on "Boats That Go Backwards."

The Association is composed of about sixteen clubs, and one of its aims is to promote the interests of power boat men. One would think that there could have been enough boats present to justify the time, energy and money used in staging what could have been a first-class regatta.

In the A, B, C, and E restricted classes, there was a grand total of eight boats entered, four of these being powered by commercial engines. There were also present about twelve straight-running boats.

I heard several remarks such as "early in the season," "teething troubles," etc., etc. When does the pole racing season start, and now long do teething troubles take to rectify?

I am not a boating enthusiast myself but as one of the organisers, and a club secretary, I am keen on furthering the sport. I think that at least the lads might have turned up and "had a go."

I suggest that Mr. Benson follows up his recent article on regattas, by publishing one entitled "How To Keep 'em Running."

Yours faithfully,
F. H. GRAY.
Catford. Kent M.E. Society.

The Compound Traction Engine

DEAR SIR,—*Re* Mr. Wedgwood's very interesting defence of the compound traction engine, I quite agree with him that they are more easily handled than a single by a driver not used to the latter. My assertion was that there was nothing in the economy claimed when on ordinary road work which entails constant stopping and starting.

I see he is under the impression that he is one of the few who can couple up to a heavy load; as a matter of fact, I and another firm were the only heavy-haulage contractors in London at one time, and I hauled the majority of the heavys out of Marylebone goods yard, once with an 85-ton load.

I had three Lion type Fowlers and one single Burrell, and when working in tandem always drove the hinder, so I know all about coupling up. I have twice seen a drawbar pushed through a tender owing to jerky reversing.

For some years I was chief technical engineer to Messrs. Clayton & Shuttleworth, and during that time ran a fuel economy test of a compound and a single, each engine on the same haul at the same time and conditions. The single won the day.

Yours faithfully,
Oxford. F. J. BRETHERTON.

Old Beam Engines

DEAR SIR,—I was recently invited to visit some very old and interesting beam winding and pumping engines in Derbyshire. These engines are situated around Matlock, and the first one visited was at Middleton. It was a two-cylinder beam engine, 25 in. bore and 5 ft. stroke, working pressure, 5 lb. per sq. in. This engine, built by Butterly & Co., in 1825, and still in daily use is used for hauling rail wagons up a 1 in 8 incline 1,800 yards long, in conjunction with a quarry. The rope wheel is 14 ft. 1 in. in diameter and is driven through reduction gearing. The engine is steamed by a Cornish boiler using wood as fuel, and was seen running, its performance being very good for an engine of that age.

The other engine visited was at Lee Wood pumping station, and was a beam pumping engine built by Graham & Co., of Milton Ironworks, in 1849, at a cost of £1,200.

The sizes of the steam cylinder are approximately 36 in. bore, 8 ft. 6 in. stroke. The steam end of the engine is single-acting, and the piston receives steam at 40 lb. per sq. in. on the downward stroke. On the upstroke of the piston, steam is exhausted from the top side of the piston to the underside. This, together with the weight of the pump piston or plunger, is sufficient to deliver the contents of the pump chamber, which is 56 in. diameter, has a stroke of 8 ft. 6 in., and delivers 850 gallons (3.3 tons) of water per stroke, with a working speed from 8 to 10 strokes per minute. As the engine has no crankshaft, and therefore control of the beam, which is approximately 35 ft. long, relies on the opening and closing of the steam valves, "preventers" are fitted to the beam and in case of valve failure these preventers come into contact with the entablature, thus preventing the piston fouling the cylinder bottom.

This engine is used to pump water from the Derwent into a canal but is not in regular use now, although I had the privilege to see it under steam.

Yours faithfully,
Sheffield. R. A. BARKER.

Balance Springs for the "Eureka" Clock

DEAR SIR,—Reverting to my previous letter regarding the difficulty in obtaining balance springs for the "Eureka" electric clock.

I should like to report that I have sent a drawing of the spring and collet as specified by "Artificer"

to Messrs. Devon Instruments Ltd., Countess Wear, Exeter, who have intimated that they will supply these to anyone making up this clock.

Usual disclaimer.

Yours faithfully,

Letchworth. A. E. BOWYER-LOWE.

Soft-soldering

DEAR SIR,—With reference to Mr. D. Nicholson's letter (page 302, issue of March 10th), my own method is to employ cored solder *with* a proprietary flux of the resin type. It might be supposed that if a flux is to be used in the ordinary manner, there would be no advantage to be derived from the cored solder, but in practice it is found that this is not the case. The cored solder plus flux runs more freely, and cleanly, than any combination I have ever used, and this method can be recommended in all circumstances where work of the highest quality and finish is desirable.

Yours faithfully,

London, W.1. JOHN H. AHERN.

CLUB ANNOUNCEMENTS

Malden and District Society of Model Engineers

The Annual Model Power Boat Regatta will be held on Sunday June 26th, on The Kingsmere Pond, Wimbledon Common, starting at 11 a.m., Programme: Nomination Race, Hydroplanes up to 5 c.c. Hydroplanes, classes C, B and A. Steering Competition.

Buckhurst Hill Model Engineering Society

This society, which has only recently been formed, caters for all branches of the hobby, and we are anxious to bring the existence of our society to the notice of all model engineers in the district.

On May 28th we were running the 2½-in. gauge passenger track at the British Legion fete, and we have some similar engagements on no fewer than five other occasions this year.

Several locomotives are under construction including a "Hielan' Lassie," a club locomotive in the form of an Armstrong 0-6-0 in 5-in. gauge, a 5-in. gauge South African "Prairie," a 7¼-in. gauge "Royal Scot," and also a 2½-in. gauge "Flying Scotsman."

Thus, although still a very young society, we are very much alive and rapidly overcoming our teething troubles.

Hon. Secretary: E. C. MULINDER, 9, Hurst Road, Buckhurst Hill, Essex.

Eltham and District Locomotive Society

The next meeting will take place on July 7th, at the Beehive Hotel, Eltham, at 7.30 p.m., when it is hoped to produce another locomotive and a constructive talk concerning it.

At the last meeting, Mr. S. Brock (treasurer), brought along his 3½-in. gauge "Schools" locomotive, and gave a very interesting talk on its construction. The engine was greatly admired and was generally agreed to be a credit to its builder.

The visit to Eastleigh locomotive works on May 31st, was greatly enjoyed by those taking part, and voted to be a very enjoyable day.

The society's permanent track is nearing completion, and it is hoped to have it ready for a trial run in July. The official opening day will be arranged later when neighbouring society's will be invited and we shall look forward to our honorary member, Mr. W. Locke, now in Devon, to visit us with his 3½-in. gauge "Bantam Cock."

Visitors are cordially invited to the meetings.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, Catford, S.E.6.

Derby Society of Model and Experimental Engineers

It is with regret that this society has had to accept the resignation from their respective official positions, of Mr. W. Wozencroft and Mr. R. C. Sinclair, who were chairman and vice-chairman.

Mr. Wozencroft has taken an appointment in the north of England and Mr. Sinclair is unable to devote the time necessary to fulfil his obligations to the society owing to the pressure of business.

In addition, we have suffered the loss of one of the founder members of the society—Mr. D. O. Whitehead—who has moved to Wakefield.

Nevertheless, in spite of our setbacks we are making good progress. The multi-gauge locomotive track and the 4 mm. scale layout are both developing, and, under the guidance of Mr. W. M. Smith, the "live steam" men are building a 5-in. gauge club locomotive.

The dates of the annual exhibition will be September 20th-24th, 1949, at the Assembly Hall, Queen's Hall, London Road, Derby.

The committee wish to impress upon all model engineers, that this society has an interest in all branches of the hobby, and we shall be glad to welcome all who are enthusiasts, whether their interest be in engines, locomotives, ships or handicrafts in general.

Recent events have included a British Railway film show, a visit to the Derby telephone exchange, an oxy-acetylene welding demonstration and a visit to the National Coal Board's rescue station at Ilkeston.

A visit to the marshalling yards of the L.M. Region, at Toton, is being planned.

Joint Hon. Secretary: W. K. WALLER, 37, Douglas Street, Derby.

Barnoldswick and District Model Engineers' Society

The society was addressed on Wednesday, May 11th, 1949, by E. W. Fraser, member of the London Society of Model Engineers, and winner of the first Championship Cup offered by THE MODEL ENGINEER.

Mr. Fraser's subject was "The Evolution of the Turning Lathe" and was illustrated by lantern slides, and as may be expected, was enthusiastically received.

On Friday, May 27th, 1949, the society was favoured by a lecture given by Mr. E. N. H. Davies, B.Sc., A.M.I.M.E. (of the Davies-Charlton Co.), the subject being "Model Diesels," which proved most practical and instructive and was followed by a most helpful discussion.

Hon. Secretary: A. BERRIDGE, The Orchard, Coates, Barnoldswick, Via Colne.

The Wicksteed Model Yacht and Power Boat Club

We shall be very pleased to see old and new friends at our Timpson Trophy regatta at Wicksteed Park, on Sunday, July 3rd. Competitions for 30 c.c., 15 c.c. and 10 c.c. will be held.

Mr. D. Ward will be in charge of proceedings. The secretary will be on holiday, but wishes all the best to all competitors.

Hon. Secretary: J. G. SKEWS, 3, Lyveden Place, Kettering.

Glasgow Society of Model Engineers

After the power boat meeting at Maxwell Park, Glasgow, on June 25th, at 3 p.m. (Scottish Speed Championships, i.c., c.i. or steam—every type and capacity), the holiday season will intervene until August 27th. Meantime the regular informal meetings at the "Rooms," 60, Clarendon Street, Glasgow, N.W., will continue every Saturday from 7 p.m. The railway site is progressing fast, and large hopes of an official opening this year seem bright.

Visitors will be welcomed and particulars of membership can be had from the address below.

Secretary: JOHN W. SMITH, 785, Dumbarton Road, Glasgow, W.1.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 23, Great Queen Street, London, W.C.2.